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VOLUME 26 | MARCH 22, 1937 | NUMBER 6

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American Dyestuff Reporter, Vol. 26, No. 6, March 22, 1937. Published every other Monday. Copyrighted, 1937, by Howes Publishing Co., 440 4th Ave., New York, N. Y. Domestic subscription, $5.00; Canadian, $6.00; foreign $6.00. Entered as second-class matter, Nov. 6, 1919, at the New York, N. Y. Post Office, under the act of March 3, 1879.

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# AMERICAN DYESTUFF REPORTER

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*Official Publication of the American Association of Textile Chemists and Colorists*

THE OBJECTS OF THIS ASSOCIATION ARE:

*"To promote increase of knowledge of the application of dyes and chemicals in the Textile Industry.*

*"To encourage in any practicable ways research work on chemical processes and materials of importance to the Textile Industry.*

*"To establish for the members channels by which the interchange of professional knowledge among them may be increased."*

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AMERICAN
DYESTUFF REPORTER

VOLUME 26 MARCH 22, 1937 NUMBER 6

## A New Research Viewpoint in the

# Dyeing of Cellulosic Textile Fibers

WANDA K. FARR

THE dyeing of natural cellulosic textile fibers has long been known to be intimately concerned with the microscopic structure of the fibers as well as with their non-cellulosic constituents. The physical and chemical problems involved have held an important position in the field of dyeing research. Many of the results of these investigations have found their way into our modern industrial technique. Forms of pre-treatment of fibers so evolved have been concerned primarily with the removal of substances referred to as "oils," "waxes," "pectic materials," etc. These have existed presumably in the form of surface coatings upon the comparatively thick hollow tube of "cellulose" which makes up the greater part of the mass of the single fiber. The cellulosic portion of the membrane, freed from its dye-proof or dye-resistant coverings then reacts more readily with the dye.

In the more detailed interpretations of these reactions, extensive use has been made of the theoretical submicroscopic structure of cellulose. In some instances the relationship between the crystalline structural units and the dye is believed to be that of simple absorption; in others an "intramicellar" action is said to be involved. In all cases the supposed invisibility of the structural units in the fiber wall prevents the use of direct visual methods. Our knowledge of what is really happening when a fiber is immersed in a solution of dye has been based therefore upon indirect evidence.

During the past five years microscopic studies of the formation and structure of the cellulose membranes of many different types of plant cells have shown that in all of these walls, including those of the fibers, there exists a microscopically visible structure and that the "cellulosic" portion of the membrane is neither physically nor chemically homogeneous. These observations alter our viewpoint with respect to the current interpretations of the reactions of fibers to various types of dyes.

Cellulose in the form of small, uniform sized ellipsoid particles has been identified in the living cytoplasm of young plant cells which are forming cellulose membranes. At first entirely separate and scattered throughout the cytoplasm, later in bead-like chains in the other regions of the cytoplasm, they finally lose their identity in a close linear arrangement to form the single fibril of the cellulose membrane. Each particle is arranged with its long axis parallel to the axis of the fibril. Hundreds of fibrils enter into the formation of the concentric lamellae of the mature cell wall. Investigators of the past century believed the small granular structures to be protein because they stained yellow with iodine. They were referred to as "granules," "particles," "microsomes," and "dermatosomes." Many of their fragmentary and scattered observations have a new significance in the light of a more comprehensive study of the *cellulose particle* from its first appearance in the living cell to the time of its final location as a permanent structural unit of the plant cell wall.

Celulose particles are very numerous in young cotton fibers and may be readily removed from the living cytoplasm for more specific study. Their shape is ellipsoid with a major axis of approximately six one-hundred-thousandths of an inch and a minor axis of approximately four one-hundred-thousandths of an inch. They are weakly doubly refractive in polarized light and stain brightly with ruthenium red. When treated with a weak solution of either acid or alkali and washed with water, they are much more clearly doubly refractive and no longer stain with ruthenium red. Evidently a material covering the surface of the particle which had lowered its brightness in polarized light and had reacted to the stain was removed by the treatment. The refractive indices of the washed particles are 1.565 lengthwise and 1.530 crosswise. When treated with sulfuric acid and iodine they swell and are colored blue. Their X-ray diffraction pattern is that of native cellulose.

As the development of the cotton fiber continues, particles are seen in the outer part of the cytoplasm arranged

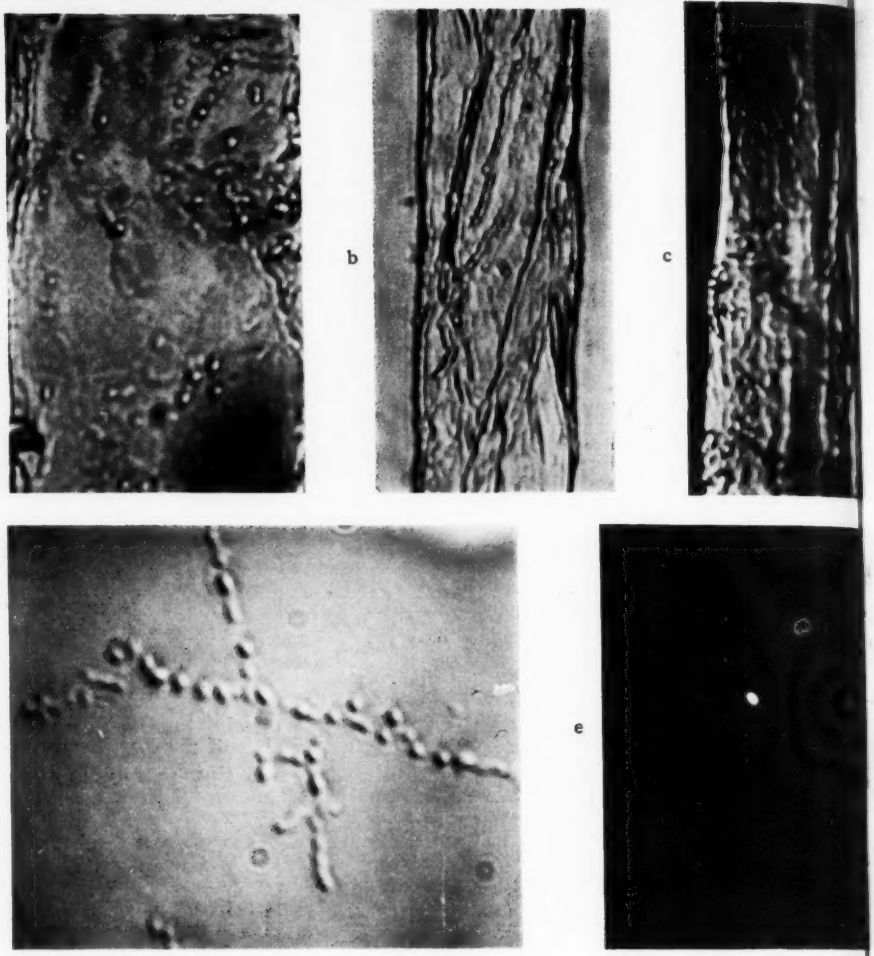


Figure 1

a. Cellulose particles, separate and in short chains, in living cell. X 1380.

b. Fibrils and particles in slowly disintegrating cotton fiber in ordinary light. X 1380.

c. Fibrils and particles in slowly disintegrating cotton fiber in polarized light. X 1380.

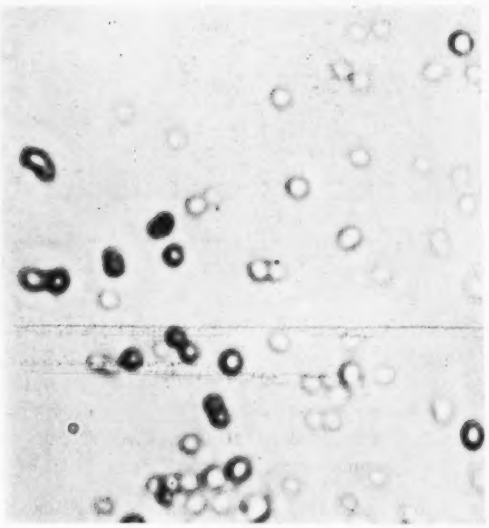
d. Separated particles from disintegrated cotton fiber. X 1630.

e. Single particle from disintegrated cotton fiber in polarized light. X 1630.

end to end in a single strand. Finally, the microscopic identity of the particles in the chain is lost in the formation of the single fibril of the cotton fiber wall. The fibrils are ultimately arranged spirally in the lamellae which constitute the mature membrane. The substance which covers the surfaces of the particles plays the important part of a cement which holds together the particles in this process of wall formation. The membrane of the mature cotton fiber is therefore a very intricate structure of ellipsoid *cellulose particles* held end to end to form a fibril and the fibrils in turn to form the lamellae by a *cementing material* which surrounds them.

The cementing material, which constitutes not more than three or four per cent of the entire fiber mass, may be extracted with either weak acids or alkalies. One of its constituents is undoubtedly pectic. The exact proportion of pectic material and the nature of the associated constituents are not yet determined. These extractions bring about a very slow disintegration of the fiber and have their chief value in the recovery of the cementing material for further chemical analysis. Much more rapid membrane disintegration is brought about by treatment with strong hydrochloric acid (sp. gr. 1.19) or gaseous hydrochloric acid. The fiber wall is broken down first into larger and then into smaller fragments, each of which may be resolved into its constituent particles by slight mechanical treatment. In all of these instances we are dealing with membrane disintegration and not cellulose degradation. The properties of the particles themselves are not different from the properties of those which have been taken from the living cytoplasm.

It has long been known from both microscopic and X-ray diffraction analyses that the textile fibers have definitely crystalline properties. According to Nägeli's hypothesis, upon which the interpretations of cellulose reactions have been based for the past seventy-five years, the cellulose membrane is made up entirely of submicroscopic micellae. This conception has not adequately accounted for many of the colloidal reactions of the membrane. It is of interest to note, however, that there is a strict agreement between the principles underlying the original micellar hypothesis and our own description of the structure of cellulose membranes. Nägeli postulated the presence of submicroscopic crystallites in orderly arrangement; we see the crystalline cellulose particles in orderly arrangement. Nägeli placed the membranes in water and considered the swelling which resulted to be due to the entrance of the water between the micellae; we observe in the moistened fibers the swelling of the protective colloidal material and the consequent pushing apart of the particles. It is therefore not necessary to account for both the colloidal and the crystalline properties of the



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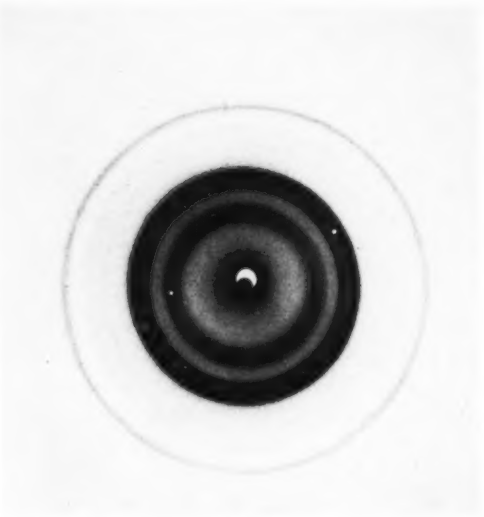

b

c

**Figure 2**

a. **Sulfuric acid-iodine reaction of separated particles from the cotton fiber. Swelling and blue colorations indicate their cellulose nature. X 1380.**
b. **X-ray diffraction pattern of ground cotton.**
c. **X-ray diffraction pattern of separated particles.**

**Figure 3**
**Cementing material extracted from cotton fibers with ammonium oxalate and precipitated with hydrochloric acid. The quantity of precipitate obtained varies with the time length of extraction.**

cellulose membrane upon the basis of the reactions of a single organic chemical. The cellulose particles will account for the crystalline behavior and the cementing material for the colloidal behavior. In a fiber reaction we are dealing, therefore, not with cellulose alone, but with a plant cell membrane of both physical and chemical complexity. Paradoxical as it may seem, the recognition of this complexity greatly simplifies our outlook for the future in fiber research.

From the viewpoint of the separable membrane constituents and their original relationship in the untreated fiber, we have a new experimental approach to many of the problems involved in the reactions of fibers to dyes. We must learn whether or not the particular dye in question reacts with the surface of the fiber, with the cementing material over the surface of the particles, with the particle itself, or with the entire mass of membrane materials. In all of these determinations, such general problems as the extent of the reaction, optimum conditions for its completion, its fastness, etc., must be investigated simultaneously. For the time being many of the theoretical bases for experimental procedures may be abandoned while observations of the specific reactions of the visible membrane constituents are under way. Where these observations may lead is unknown. We have merely a new viewpoint for more tangible research, not an immediate application.

## Application of Exact Knowledge to

# Problems of the Textile Industry*

R. E. ROSE†

EXACT Knowledge, is my theme. What then is it to know exactly, or to know at all for that matter? Experience is the greatest of all teachers and knowledge begins in the simple reactions of simple beings—instinct we call it. And instinct is a very exact knowing, provided the circumstances are of the same pattern as produced ability to respond, but change them and the response is senseless—the spider will carry a little stone in place of her little sack of eggs if it is substituted, and the foster bird rears the cuckoo.

The great reptiles of the age of the dinosaurs carried the least brains for a given body weight of all the long series of vertebrate beasts produced by nature, ¼ oz. to a ton; next in order of more adequate mental facilities came the primitive warm-blooded creatures and then such intelligent beasts as dogs and men. The average dog has more brains than 72 dinosaurs weighing 20 tons each and man has no less than 50 lbs. of brains to a ton of body weight, sufficient for a herd of 3,600 dinosaurs.

### Advisability of Determining Cause and Effect

What has all this to do with exact knowledge? A great deal because the first thing that the big brain of man did was to create an immense body of what Thomas Carlyle called no-science. A thinking being tries to explain; his senses may bring him accurate impressions but he interprets them instead of merely responding to them and falls into the great pitfall in which are engendered all the superstitions, the ungrounded fears, the Gods of Wrath and the evil spirits that haunt sinister night and ride the raging storm. More and more he ties perfectly simple facts to monstrously complex explanations; he is not sick because of any weakness of his own but because his enemy has cast a spell upon him; the rain comes because he has made sacrifice to an irate god; the crop fails because the moon was not in the right quarter.

This wealth of superstitious inaccuracy beginning with the first thinking man, grew and grew until man came to prefer foolish explanations and considered logic more accurate than fact. What changed this? It began to change the moment the brain began to question the accuracy of the senses. Galileo's classical experiment of the falling objects is typical of all the experiments that have since been made.

For our purpose today we can say that exact knowledge is the result of a direct or indirect sense impression rendered accurate by instruments which aid the senses or by a rational arrangement of conditions set up to test cause and effect; the experimental method.

### Exact Knowledge Applied to Textiles

The textile industry is the outgrowth of the very primitive household arts of spinning, weaving and dyeing.

The basic material of the industry is always fibrous, be it cotton, wool, silk, rayon, linen or jute. It is primarily a product of agriculture, animal husbandry or sylviculture; by the application of power and the use of chemicals this raw material is gathered, purified, fabricated and finished.

Exact knowledge is important at every stage of this long series of steps and not necessarily hard to get.

With a small garden for laboratory and two strains of peas for experimental material, Mendel ascertained the real facts of heredity. If the cotton mills of New England had been farsighted enough to spend a trifling portion of their profits in a further study of the exact facts of heredity as applied to cotton, it would have been a very paying investment, yet the investigation would not have been costly. Then as now they adopted the attitude that cotton growing was none of their business. They became interested only in the purchase of ginned cotton, thus ignoring the fact that the grower of cotton was not in any way scientific, was incapable of a collective effort, and could not be expected to modify his strains systematically but would merely retain a certain amount of cotton seed each year.

Of course, it may be said that the cotton growing states should have done this; but they did not, they are only beginning to do so now, in spite of the progress in plant breeding elsewhere. The big mill owners left unused a great opportunity that was theirs. Unlike the mill executives the tomato soup and ketchup making concerns have spent many hundreds of thousands of dollars in breeding the tomato best suited to their purpose and seeing that it is supplied to the farmers who raise the crop and they have found this most profitable.

Wool was in a rather different position; it was always more or less a precious fiber and animal breeding was understood much better than plant improvement. Moreover the difference between animals is easier to see and measure than that among many thousands of individual

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* Presented at annual meeting, C.A.T.C.C., Ontario Section, Hamilton, Ontario, February 6, 1937.

† E. I. du Pont de Nemours & Co., Inc.

plants, just as the result of crossing is more evident. It is possible that a more precise effort to establish earlier the exact minor factors in sheep breeding might have been a real benefit to the woolen mill, but because this was being done empirically and yet fairly successfully by the farmer this is not so certain.

The best chance for advance would have been in a very minute study of the relation of diet and forage to the quality of the fleece, a study which is now actively under way and one which is already productive of important results. However, it is only fair to say that this investigation has been successful because of a knowledge of facts regarding the basic chemical composition of wool which were unknown a comparatively few years ago. A fact furnishing another example of the necessity for exact basic knowledge before much progress can be made in an industry.

As for silk, we all remember, that this industry might have perished entirely had not the government of France had the good sense to obtain exact knowledge of the characteristics of the ravaging disease that was destroying the worms by the hundreds of thousands, and also the good luck to find a real scientist to do the work, Louis Pasteur.

### Study of Power Equipment and Manufacturing Machinery

Fundamental to all modern textile undertaking is the use of power. It does not appear that the industry would have gained much by a study of power production—the engineering groups took care of that when the steam engine was the prime mover and also when power was generated in the dynamo and transmitted through the motor. It is interesting in this connection to review the immense advance made in converting the chemical energy of the exothermal union of coal and oxygen under the boiler into mechanical energy. In Watt's time it required thirteen pounds of coal to produce one kilowatt hour of energy, other than heat and light. Now the great steam plants burn only three-quarters of a pound to get as much. The improvement is still going on based on a better knowledge of the exact properties of steam at high temperatures and on the availability of new steel alloys.

The fingers of the textile industry, the breakers, cards, spinners, mules, looms, tenter frames, jiggers, padders, knitting machines, to mention but a few, are largely the outcome of the intimate practical knowledge obtained by the worker in the mill, aided by the engineering industries who furnish the exact knowledge of the mechanics necessary. While this development of the mechanical implements of the industry is a striking monument to human ingenuity, one which cannot fail to arouse the admiration of the observer, yet, it is the achievement rather of the mechanic than the scientist, and the intangible factor has not always received its just share of attention. I remind you that the most successful practical research of the great Shirley Institute so far has been the mathematical analysis of the motions of the loom with its flying shuttle. That is a kind of exact knowledge one could not expect of the mechanical genius who sees the interrelated motions of his beautiful substitutes for human fingers.

There is still much to do in this difficult field—yarns are easily injured in passing through the many machines in the mill and the best conditions for handling them cannot be decided upon without exact measurements of the effects of tension, lubrication, temperature, moisture content, contact with metals and many other cause and effect relations that are extremely difficult to analyze exactly. And these questions must be given different answers as we modify our fibers, changes which are inevitably to become of more significance as the years go by and the fiber creations of the chemical industry become more and more important.

### Textile Development Due to Science of Chemistry

No other field of exact knowledge has had more influence on the textile industry than the science of chemistry. Two of the first commercial chemicals, sodium hydroxide and chlorine (as hypochlorite) made the intense development of the cotton industry possible when once machine spinning and weaving were invented. Many new processes have come and gone but mercerizing is still of primary importance and as for chemical bleaching the modern cotton mill is unthinkable without it.

The making of barium peroxide in the laboratory furnished another bleaching agent, hydrogen peroxide. Like other new products, hydrogen peroxide was at first much too expensive for the mill. What made it available was the fact that another peroxide forming metal, sodium, became essential to the chemical industry for the production of synthetic indigo. When this problem was solved metallic sodium was so cheap that the peroxide made from it could be used to produce a cheap hydrogen peroxide, cheap enough in fact to allow of its introduction as a wool bleach.

In 1838 the great German chemist, Justus von Liebig, the first man to establish a real chemical laboratory, devised a quantitative method for the analysis of carbon compounds. This was purely a research tool and made no impression at all on the textile industry of the time. Using this method gave science the first inkling of the nature of cellulose; its composition was found to be exactly like that of cane sugar. Later work showed that the constitution resembled that of cane sugar also in that it was characterized by the presence of hydroxyl groups. From this it was obvious that it should be possible to convert these groups into esters. Having done this with nitric acid, it became equally obvious that a new explosive had been discovered. This was not so very long ago because my mother had the experience of setting off a boom-torpedo, the explosive charge of which was the new material gun cotton; this was still in the days of wooden fighting ships. The solution of gun cotton, viscous as it was, excited the imagination of Count Hilaire de Chardonnet, who started experimenting with the making of nitrocellulose threads, which were subsequently hydrolyzed to re-

generated cellulose—the first rayon— a conspicuous industrial application of exact knowledge to the textile business.

### Aggressive Research by Rayon Manufacturers

Later Cross and Bevan made their discovery, purely as an outcome of a basic research on cellulose, that the rather indefinite sodium compound of cellulose interacted with carbon disulfide to produce an orange material soluble in water and very easily decomposed to regenerate insoluble cellulose.

This turned out to be the most economical of all processes for the making of rayon. Of course, an immense amount of work, largely of a mechanical type, had to be done before spinning this fiber became an accomplished industrial achievement. But now we can see that those men who made it their business, not to see cotton only with their eyes but to learn exactly what it was, were modifying the textile industry more profoundly than it had been altered since the coming of the mechanical spinning frame and loom, and the advent of chemical bleach. The only fiber to feel this disastrously is silk, the displacing of which was slow until the marketing of the delustered rayons and acetate yarns.

But the makers of artificial fibers are not backward in seeking exact knowledge and their research groups are well staffed and abundantly supplied with funds. More and more they will push new products into the mills. Staple fibers are bound to assume a very much greater importance as time goes on and they will tend to displace wool.

### Development of Artificial Wool

When the day comes when basic research makes possible a fiber with all the properties of wool except perhaps felting, then we shall have another illustration that research by natural evolution is no match for exact knowledge made available by research and put to use in industrial achievement. Then the wool grower will begin to feel the competition of artificial fibers just as the silk cultivator has done. The only chance is for the woolen industry to develop an equal versatility. In Great Britain the results so far obtained by the Woollen Industries Research Association under the very able direction of Mr. B. H. Wilsdon show that much can be done to make it harder to compete with wool.

Felting is just as much of a disadvantage as it is an advantage—it is entirely a question of the purpose to which the textile is to be put. Felting becomes very objectionable when it is evident only as shrinkage. The new gaseous chlorination process promises to make it possible to obtain an essentially non-shrinking wool. This is an outcome of very profound research because it is based upon a knowledge of the molecular structure of the animal fiber and its mechanical properties in terms of the arrangement in space of its atoms. It is another inescapable proof of the fact that exact knowledge is a much better guide to industrial success than mere experimentation with the sole purpose of obtaining immediate profits.

Another success of a different kind is due to the efforts of the same research group. Wool has always been bleached with sulfurous acid, although hydrogen peroxide has been gaining ground; white wool has always tended to become yellow with age; only now do we know that sulfurous acid takes away the yellowness but changes the fiber in such a way that more yellowness is produced later. If a salt of sulfurous acid, a sulfite, is substituted for the acid, the removal of the yellow is effected without the production of the material which causes a later reappearance of the discoloration; thus a small alteration and not a costly difference in process removes one of the disadvantageous characteristics of wool.

### Need for Constant Improvement of Raw Materials

Any material to survive in the struggle for useful existence in modern industry must be aided by research, that is, the findings of pure science and their application to industrial problems.

Here let me emphasize a fact of great significance. The statement I have just made has become axiomatic to a very considerable extent among those responsible for the profitable conduct of the textile business on the Continent, in the British Empire, and in Japan. The best evidence of this is found in Great Britain where the textile industry supports real research, aided, it is true, by government grants. The industrial leaders in the textile mills are willing to contribute to this work not merely a few thousand but tens of thousands of pounds sterling and something like 84 per cent of the whole industry contributes. This is remarkable and it is bound to give the British mills a resilience, a capacity to fight back in competitive matters, an ability to open up new and profitable fields that will make all the difference between success and failure in the years to come.

In Japan the same attitude is apparent, only the system followed is different. Not long ago I received a leaflet from London describing some very special and costly equipment that could well be used in certain kinds of fiber research. In the list of those to whom these instruments had been supplied, Japan stood first. Please do not misunderstand me; similar instruments are made in the United States and in Germany, so that the list is no accurate measure of the standing of all countries; but it is interesting to find a nation of recent years, a phenomenal producer of textiles, so obviously using every scientific method of competition, instead of being content simply to take advantage of its economic weapons in international trade. It is this spirit that will lead to advance and woe betide the industry that does not keep in the van.

### Successful Work of the A. A. of T. C. C.

Saying this prompts me to a few remarks regarding the state of affairs across the border. A small group of enthusiasts, impressed by the lack of exact knowledge

***Continued on page 173)***

PROCEEDINGS OF THE
# American Association of Textile Chemists and Colorists

MARCH 22, 1937

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## ANALYTICAL METHODS

The Council has authorized the republication of the "Analytical Methods for a Textile Laboratory" in the 1937 Year Book. The committee in charge of this section will be glad to correct any errors or omissions in these methods as published in the 1935-36 Year Book. The members of the A. A. T. C. C. are therefore requested to review these methods and send to the chairman of this committee not later than March 15, 1937, any suggestions for the improvement of the existing methods or any new methods which seem suitable to include in this section.

Walter M. Scott, Chairman,
857 Boylston Street,
Boston, Massachusetts.

## REPRINTS

### Analytical Methods

Reprints of the Analytical Methods as printed in the 1935-6 Year Book are now available from the secretary of the Association for $.75 per copy postpaid.

## CALENDAR OF COMING EVENTS

**Meeting, Northern New England Section. University Club, Boston, Mass.. April 2, 1937. Speaker: Milton Harris on "The Chemistry of Wool."**

* * *

**Meeting, Philadelphia Section, duPont Hotel, Wilmington, Delaware, April 9, 1937.**

* * *

**Spring Meeting, Piedmont Section, King Cotton Hotel, Greensboro, No. Carolina, April 17, 1937. The Council will also meet there on the morning of the same day.**

* * *

**Annual Meeting and Convention, December 3 and 4, Bellevue-Stratford Hotel, Philadelphia, Pa.**

# The Reaction of Wool

## With Strong Solutions of Sulfuric Acid*

MILTON HARRIS† RALPH MEASE** and HENRY RUTHERFORD†

**Data on the effect on wool of treatment with solutions of sulfuric acid of different concentrations at 5, 25, and 50° C. for 15 minutes and of an 80 per cent solution of sulfuric acid at 25° C. for different lengths of time are presented. The results suggest that strong sulfuric acid reacts with the basic groups in wool to form sulfamic acid derivatives. The acid-combining capacity decreases and the base-combining capacity increases in proportion to the number of sulfamic acid groups formed in the wool.**

### I. INTRODUCTION

THE use of strong solutions of sulfuric acid for the removal of cotton from mixtures with wool has been suggested by several investigators[1, 2, 3]. In studies relating to the analysis of wool-cotton textiles, Mease and Jessup[4] found that during treatment with an 80 per cent solution of sulfuric acid‡, wool gained from 5 to 8 per cent in weight. Their results indicate that a relatively stable compound is formed since this combined acid is not removed by prolonged washing with water or with solutions of ammonium hydroxide, sodium carbonate, or triethanolamine.

The present investigation was undertaken to study the nature of the reaction of wool with strong solutions of sulfuric acid and to study some of the properties of its product.

### II. MATERIALS AND METHODS

The material used in this work was worsted cloth, plain weave, weighing 8 ounces per running yard (56 inches wide) or white worsted yarn prepared from raw wool which had been extracted with Stoddard solvent and washed with water. All the samples were further purified by extractions with alcohol and ether, followed by washing with water at about 50° C.

The samples of wool were treated with about 50 times their weight of sulfuric acid solutions. After the treatment with acid, the wool was immediately transferred to a large volume of running cold water and vigorously stirred in order to prevent local heating during the dilution of the excess acid. The samples were then washed in running distilled water until the wash waters no longer gave tests for sulfate, the time required generally being about 72 hours§. The test for sulfate was made by allowing the samples of wool to remain in contact with a small amount of distilled water for about one-half hour and testing the liquor with barium chloride.

The percentage increase in weight of the wool before and after treatment was computed on the basis of the oven-dry weight.

The combined sulfuric acid in the wool was determined by the method of Mease[5]. Ammonia nitrogen was determined by measuring the ammonia liberated when the wool was boiled in a saturated solution of magnesium oxide.

The yellowing of the wool by the acid treatment was determined by measuring the reflectance of the sample with respect to a magnesium-oxide standard, at wave length 435.8 millimicrons, with a Marten's photometer, mercury arc lamp, and suitable filter. The reflectance of the dyed samples were determined with the same instrument at wave length 578 millimicrons, which is located in the region of maximum absorption for the blue dyes used.

The breaking strength of the cloth was determined on a pendulum-type testing machine using the strip method. The samples were 6 inches long and 1 inch wide, cut warpwise of the cloth. The distance between the jaws was 3 inches at the start of the test. All the samples were conditioned and tested in a room maintained at a relative humidity of 65 per cent and a temperature of 70° F.

The acid- and base-combining capacities were determined by soaking samples of the wool for 4 hours (equilibrium appears to be reached in this time) in 0.1 N solutions of hydrochloric acid***, sulfuric acid and sodium hydroxide, the last being at 1 to 2° C. to prevent decom-

*Publication approved by the Director of the National Bureau of Standards of the U. S. Department of Commerce.

†Research Associate at the National Bureau of Standards representing the American Association of Textile Chemists and Colorists. The work reported here was aided by grants from the Textile Foundation, Incorporated, and the Chemical Foundation, Incorporated.

**Chemist, National Bureau of Standards.

‡This concentration was obtained by mixing 80 ml. of concentrated sulfuric acid (94 per cent, Sp. Gr. 1.84) with 25 ml. of water. The wool was immersed for 15 minutes in 80 to 100 times its weight of solution at room temperature.

§Samples of wool which had been treated with a 4 per cent solution of sulfuric acid for 30 minutes and then washed for 72 hours, regained 98 to 99 per cent of their original acid-combining capacities.

***The limiting acid-combining capacity appears to be reached at about pH 1.

position of the wool fiber. The amount of acid or base combined was then found by titration of an aliquot of the mother liquor.

## III. RESULTS AND DISCUSSION

### 1. Effect of Temperature and Acid Concentration

In view of the procedures[4] recommended for the removal of cotton from mixtures with wool by the sulfuric acid method, it seemed advisable to study first the effect of different concentrations of sulfuric acid on wool. The effects of the different treatments at 5, 25 and 50° C. for 15 minutes are summarized in Table I. The results indicate marked changes in the amount of acid combined between 69 and 80 per cent sulfuric acid at 5 and 25° C. and between 48 and 60 per cent acid at 50° C. Since wool, in an 80-per cent solution of sulfuric acid at 25° C. reacts with a relatively large amount of acid, as shown by the sulfate analyses, and since the reaction is accompanied by comparatively little deterioration of the fiber, as evidenced by reflectance, breaking strength and ammonia nitrogen determinations, this concentration and temperature of acid solution were chosen for the further studies.

**TABLE 1**

**Effect on Wool of Treatment with Different Concentrations of Sulfuric Acid at 5, 25, and 50° C. for 15 Minutes**

| *Concentration of $H_2SO_4$ by weight* | *$SO_4$ from sulfuric acid treated wool* | *Reflectance* Rx/RMgO* | *Breaking strength 1-in. strip* | *Ammonia nitrogen* |
|---|---|---|---|---|
| Per cent | Per cent | | lbs. | mg/g |
| | | **Temperature, 5° C.** | | |
| 19 | 0.42 | 46.2 | 29 | 0.43 |
| 34 | .66 | 47.1 | 29 | .42 |
| 48 | .68 | 47.0 | 29 | .41 |
| 60 | .64 | 47.5 | 29 | .48 |
| 69 | .69 | 46.2 | 29 | .43 |
| 80 | 1.02 | 46.3 | 27 | .43 |
| 85 | 3.42 | 44.3 | 28 | .50 |
| 94 | 11.00 | 43.9 | 26 | 1.67 |
| | | **Temperature, 25° C.** | | |
| 19 | 0.88 | 45.6 | 28 | .52 |
| 34 | 1.20 | 47.8 | 28 | .48 |
| 48 | 1.21 | 46.1 | 28 | .68 |
| 60 | 1.38 | 46.0 | 26 | .64 |
| 69 | 1.37 | 45.3 | 27 | .52 |
| 80 | 6.91 | 43.2 | 26 | .60 |
| 85 | 10.20 | 40.4 | 24 | 1.20 |
| 94 | 11.70 | 39.1 | 23 | 2.28 |
| | | **Temperature, 50° C.** | | |
| 19 | 0.65 | 47.6 | 28 | .43 |
| 34 | 0.71 | 47.1 | 26 | .63 |
| 48 | 0.72 | 47.0 | 25 | .62 |
| 60 | 3.50 | 41.2 | 18 | .70 |
| 69 | 3.79 | 37.0 | 16 | .79 |
| 80 | 6.14 | 35.4 | 19 | .92 |
| 85 | 8.13 | 34.7 | 21 | .91 |
| 94 | 9.39 | 35.2 | 21 | 1.60 |

*The values represent the ratio of the brightness of the sample to that of a standard white magnesium oxide surface under the same conditions of illumination and observation, for light of wave length 435.8 millimicrons. The darker (or yellower as in this case) the specimen, the smaller the value for light reflected.

### 2. Effect of the Duration of Treatment

Samples of wool were treated with an 80-per cent solution of sulfuric acid at 25° C. for different lengths of time, and washed as previously described. The increase in weight and the sulfate obtained from the treated wool are recorded in Table 2. The data indicate that a maximum increase in weight is obtained in the treatment for 30 minutes. On treatment for periods longer than 30 minutes, the wool not only decreases in weight, but the amount of sulfate obtained from it also decreases. The appearance of the wool treated for periods of longer than 30 minutes indicates that considerable degradation has occurred.

**TABLE 2**

**Effect on Wool of Treatment with an 80 Per Cent Solution of Sulfuric Acid at 25° C. for Different Lengths of Time**

| *Duration of treatment* | *Increase in weight* | *$SO_4$ from treated wool* |
|---|---|---|
| min. | Per cent | Per cent |
| 3 | 0.56 | 0.81 |
| 6 | 2.35 | 3.53 |
| 9 | 3.82 | 4.82 |
| 12 | 5.60 | 6.37 |
| 15 | 6.20 | 7.23 |
| 20 | 6.77 | 7.90 |
| 30 | 7.19 | 8.38 |
| 40 | 7.03 | 8.34 |
| 60 | 6.71 | 7.78 |
| 105 | 6.58 | 7.17 |
| 150 | 4.93 | 6.74 |

### 3. Nature of the Reaction of Wool with Strong Sulfuric Acid

Of the two principal theories to account for the acid taken up by wool, namely, the chemical and the physical or adsorption theories, the work of Knecht[6], Mayer[7], Porai-Koschitz[8], and Speakman[9] favors the former. These investigators showed that wool has an acid-combining capacity of about .80 millimols of acid per gram of wool. In addition, Harris and Kanagy[10] showed that this combined acid may be accounted for by the free amino groups and by the guanidine nucleus of the arginine in wool. Speakman[9], utilizing his own data and also the data of Dietl[11], Fort and Lloyd[12], and Georgievics and Pollack[13] to calculate the amounts of acid combined as a function of

pH, demonstrated that sulfuric acid was practically monobasic in reaction with wool.

On the basis of the above work, the follow equations which give a schematic representation of two possible mechanisms by which sulfuric acid may be taken up and held by the basic groups in wool, are postulated:

(1) $RNH_2 + H_2SO_4 \rightleftarrows RNH_3.HSO_4$

(2) $RNH_2 + H_2SO_4 \rightarrow RNHSO_3H + H_2O$

where R represents the portion of the wool molecule to which the basic group is attached.

The acid in the compound formed in equation (1) should be reversibly held; that is, it should be slowly removed by washing with water, rapidly removed by pyridine[14], triethanolamine[15], sodium terephthalate[15] and other alkaline reagents, and readily replaceable by acid dyestuffs. Equation (1) indicates the reaction which is assumed to take place in dilute solutions of sulfuric acid.

On the other hand, the acid in the compound formed according to equation (2) should be irreversibly held under the conditions mentioned above. It appears that such a compound would be formed only under dehydrating conditions, for example, in the presence of strong sulfuric acid, and that the acid would be removed by hydrolytic processes* according to the reverse of equation (2). In other words, the fact that sulfate is obtained when the acid-treated wool is analyzed by the method of Mease[5], is no indication that it existed as such in the wool.

It should be possible, therefore, to determine which type of compound is formed when wool is treated with strong or dilute solutions of sulfuric acid by recalculating the data on the $SO_4$ obtained from the treated wool in terms of $H_2SO_4$ and $SO_3$ and comparing the calculated weights with the actual increase in weight of the wool after treatment with sulfuric acid. The data obtained by recalculating the data given in Table 2 are shown graphically in Figure 1. The results suggest that the reaction of wool with the strong solutions of sulfuric acid has proceeded according to equation (2) and that a sulfamic† acid derivative of wool has been formed.

That the reaction of wool with dilute solutions of sulfuric acid proceeds in a different manner, is demonstrated by the following experiment. A 2-gram sample of wool was treated with 100 ml. of a 4 per cent solution of sulfuric acid for 30 minutes, after which the excess acid was squeezed out by hand. The sample was then soaked for 15 seconds in 100 ml. of distilled water, squeezed again, and then partially dried by allowing it to remain in contact with air at room temperature for about 6 hours. It was finally dried to constant weight in the oven at 105° C.

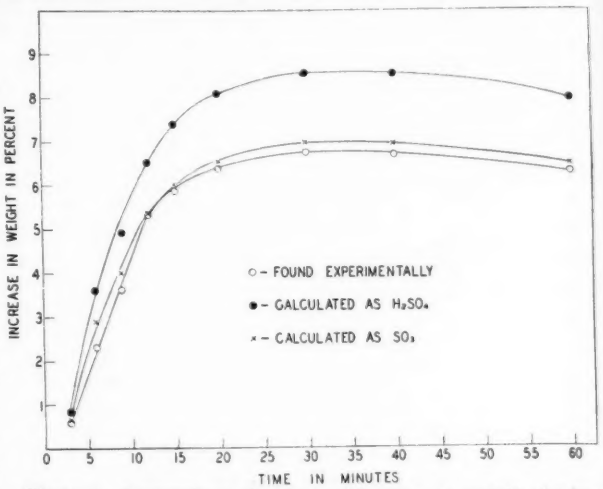



**Figure 1—Comparison of the actual increase in weight obtained after treating wool with an 80 per cent solution of sulfuric acid at 25° C. for different lengths of time with the increase obtained by calculating the $SO_4$ found in the treated wool in terms of $H_2SO_4$ and $SO_3$.**

The sample showed a 5.5 per cent increase in weight. The calculated increases in weight, based on the sulfate analyses, were 5.3 per cent calculated as $H_2SO_4$ and 4.3 per cent calculated as $SO_3$. These results suggest that this reaction has proceeded as shown in equation (1).

### 4. The Acidic and Basic Properties of the Sulfamic Acid Derivative of Wool

The reaction of the basic groups of wool with sulfuric acid to form a sulfamic acid would not only destroy the basic properties of wool but would also correspondingly increase the acidic properties. That these changes take place are shown by the data in Tables 3 and 4.

The results in Table 3 indicate a good agreement between the millimoles of hydrochloric and sulfuric acids combined with wool and again show that the latter is practically monobasic with respect to the wool. A comparison of these data with those in Table 2 shows that the

**TABLE 3**

**Acid-combining Capacities of Wool Yarn Which Had Been Treated with 80 Per Cent Solutions of Sulfuric Acid for Different Lengths of Time**

| *Duration of treatment* | *Acid-combined* | |
|---|---|---|
| | *HCl* | *$H_2SO_4$* |
| min. | millimols | millimols |
| 0 | 0.81 | 0.84 |
| 3 | .62 | .63 |
| 6 | .34 | .35 |
| 9 | .28 | .33 |
| 12 | .21 | .26 |
| 15 | .00 | .04 |
| 20 | —.08 | —.09 |
| 30 | —.08 | —.06 |
| 40 | —.11 | —.09 |

*The hydrolytic conditions necessary for the reverse of equation 2 are so drastic as to cause degradation of the wool fiber. Accordingly, equation 2 which represents the manner in which the acid is assumed to be held by the original wool fiber is written as an irreversible reaction.

†Sulfamic acids are those —$SO_3H$ compounds in which the sulfur atom is linked to a nitrogen atom.

**TABLE 4**

**Alkali-combining Capacities of Wool Yarn Which Had Been Treated with 80 Per Cent Solutions of Sulfuric Acid for Different Lengths of Time**

| *Duration of treatment* | *NaOH combined* | *Increase in alkali-combining capacity of the treated wool* | |
|---|---|---|---|
| | | *Found* | *Calculated on the basis of the combined $SO_3$* |
| min. | millimols | millimols | millimols |
| 0 | .64 | — | — |
| 3 | .80 | .16 | .09 |
| 6 | 1.17 | .53 | .38 |
| 9 | 1.29 | .65 | .52 |
| 12 | 1.39 | .75 | .70 |
| 20 | 1.50 | .86 | .88 |
| 40 | 1.62 | .98 | .94 |

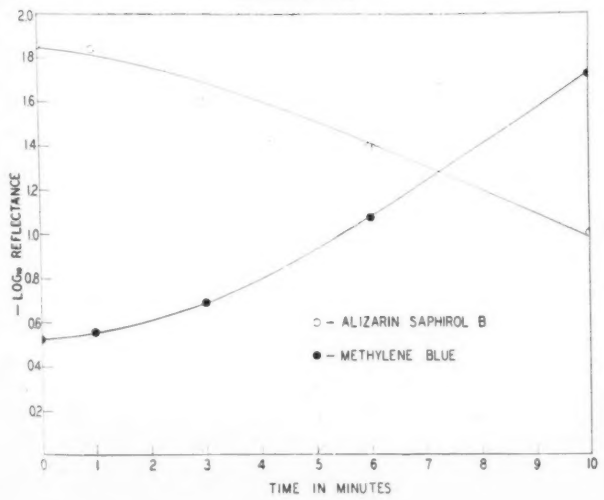
acid-combining capacity decreases as the number of sulfamic groups increases. The negative values obtained for the last three treatments (Table 3) may be accounted for in two ways. Firstly, under the conditions of these experiments it is very difficult to wash the last traces of free (reversibly-combined) acid from wool, and secondly, the long soaking even in relatively weak acid may cause a hydrolytic cleavage of portions of the wool containing sulfamic acid groups. The latter possibility is suggested by the fact that in the continued treatment with strong sulfuric acid, the amount of sulfate obtained from the treated wool actually decreases (Table 2).

Although the acid-combining capacities of the treated wools decrease, the data in Table 4 show a corresponding increase in base-combining capacity with an increasing number of sulfamic acid groups. The increase in alkali-combining capacity, as found experimentally, is in good agreement with the values, which were calculated on the assumption that one mole of the combined $SO_3$ reacts with one mole of sodium hydroxide. This also constitutes further evidence that the product of the reaction of wool with strong sulfuric acid is a sulfamic acid derivative since, if the acid were held as shown in equation (1), two moles of sodium hydroxide would be required for each mole of combined acid[14] because the wool is regenerated.

The changes in acidic and basic properties of the treated wool are also manifested in the dyeing characteristics of the fiber. Samples of wool cloth which had been treated with 80 per cent sulfuric acid solutions for different lengths of time were dyed in the same bath containing approximately 2 per cent of Alizarin Saphirol B (based on the weight of fiber). A second set of the acid-treated samples were similarly dyed using Methylene Blue.

The curves in Figure 2 show that the amount of acid dyestuff (Alizarin Saphirol B) absorbed decreases and the amount of basic dyestuff (Methylene Blue) absorbed increases with increasing time of treatment with strong sulfuric acid*.

**Figure 2—Effect of treatment with an 80 per cent solution of sulfuric acid on the dyeing characteristics of wool cloth as shown by change in reflectance of light at wave length 578 millimicrons.**




*Work now in progress suggests that the resist towards acid dyestuffs, often produced in the carbonizing process, is caused by the formation of the sulfamic acid groups.

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# Progress of the Textile Industry*

CARL SCHLATTER

AFTER the introduction of our Chairman, I think I ought to tell you first how I came to pick the subject. Well, the textile industry has had its share of troubles since the boom days of 1929. We have had temporary closings of small and large plants, permanent closings and liquidations, re-organizations, changes of ownership, wage cuts and strikes.

People directly interested in the industry as stockholders and as employees, and people in other lines of business too, have asked me, "What is wrong with the industry?" And I have heard some of these people making comparisons with the automobile industry, where progress has been very spectacular, and where especially the permanent closing of plants has been less in vogue. In making such a comparison in a superficial manner, people are apt to come to the conclusion that the troubles of the textile industry are the result of lack of progress. They say the industry is in a rut, and doesn't keep up with the times.

And some friends who were in this frame of mind have challenged me by saying, "Look at what has been accomplished by the automobile industry, which, starting from nothing, has sprung to its present gigantic proportions in three decades, and compare it with the progress made in the textile field.

All right then, let's do just that tonight, and see what we find and what we can learn.

First, as a matter of record, I want to say that during the past seven years, other industries besides textiles, in fact, the whole country, has shown signs of sickness. Just turn on your radio for confirmation,—the country was going to the dogs before, or the country is going to the dogs now, according to who the speaker is, or maybe by now it has arrived there.

Fortunately, however, not all the textile plants have gone that way. For every one which closed, there are still hundreds running. A peculiar thing is to be noted, that, of all the mills which did close, only a few had to do so on account of obsolescence of equipment; others failed obviously for other reasons. At times it even looked as though mills which kept in step with the times, and kept their equipment up to date, were the most likely to go down. In these cases, the trouble was certainly not lack of progress.

Second, I don't want anybody to believe that the automobile industry has started from nothing. The error of this becomes evident immediately when the word "automobile" is replaced by its synonym "motor vehicle." The history of the automobile is only part of the history of transportation,—it is a continuation of the invention and development of the wagon, and these are preceded by the invention of the wheel. If you look at some of the early models of cars, you see the connection readily, for they are merely stage-coaches with boxes concealing the motor stuck in front of them. Most people today would hesitate to use the word "automobile" for these contraptions.

The initial step in the development of the textile industry was made when bast fibers were first twisted together to form twine, or perhaps when branches of trees were interlaced in wicker-basket fashion to build huts. This may have been done before the wheel was used, but in the absence of any definite proof one way or the other, we say that the automobile industry is as old as ours, and both trace their beginnings back to the dark ages before history was written.

There is of course no denying the fact that during the past two decades the development of the automobile has been much more spectacular than the development of new fabrics. Yet such a comparison is not really fair. It should be kept in mind that in a car, one buys performance—performance in transportation—and in a textile fabric, one buys the product of performance.

When you compare machines with machines, or output with output, you get a different picture, e. g., the spinning frames of today compare with the wheel of 200 years ago as well as the newest car with the stage-coach.

There are a few more circumstances which favor the automobile industry; e. g., when you talk to a group of people about the streamlined cars, the manufacturer always gets credit for this accomplishment. On the other hand, when you call attention to the fact that those beautiful new rayon and acetate yarn evening gowns have brought out the streamlines of the girls, the listeners are apt to give no thought to the industry behind the gowns.

We have no yard-stick with which we can measure and compare the progress made in the various fields of endeavor. A good indication of what has been accomplished in a given period can be had by comparing what man's effort has produced per unit time, be it miles travelled, pounds spun, or yards woven. It eventually boils down to an economic problem, however.

I purposely did not say to compare cost of units produced, because costs expressed in dollars and cents of a hundred years ago cannot be compared with cost figures

*Presented at meeting, Rhode Island Section, October 30, 1936.

in dollars and cents of today. Currency units are too relative, as has been demonstrated to us in a very forcible way in recent years.

We all know the speed of automobile transportation, its comfort, dependability, and availability, and we certainly ought to know its cost. Most of us know what travel was like twenty years ago, and some of us remember travel in the nineties. We also have good historic records of travel during the eighteenth and early nineteenth centuries.

You do not have to dig down to details to see that the progress in transportation has been equalled in the textile field. Some time ago, I was shown a beautiful collection of linen table cloths, all of them fifty to a hundred years old. The owner, a lady in the eighties, proudly told me that the more recent ones were the work of her girl-hood days, while the others were woven by her mother and grandmothers. When we got to discussing the time required to produce these cloths; the units were weeks, months, and winters. A modern jacquard loom will weave similar table cloths in thirty to sixty minutes.

The same condition is found in spinning. Both the poundage and the quality of yarn produced per man has increased steadily. The dyer is producing more goods, and has available a greater variety of shades, and much better shades, at that. And when we come to printing, I ask you to compare the product of the old block-printing with that of today's machine, with its variety, brilliance, and fastness of color.

A second indication of an industry's progress can be obtained from its attitude towards inventions and developments made in other fields, and from the readiness and speed with which it puts those to work for its own purposes.

Here the textiles can score one over the motor-cars. The textile mills quickly accepted the steam engine; six years after Watt took out his first patent, one of his engines was running in a cotton mill. Later the industry was among the first to install electric lighting, and it followed that up with the use of electricity for motive purposes, just as soon as fairly dependable motors became available.

In this respect, there is one item on the auto's account which doesn't serve much to its credit. The first practical internal combustion engine was built about 1860 by Lenoir in France, but it was almost forty years later before engineers seriously set out to adapt and develop these machines for locomotion.

A third way of comparing progress in different fields is by lists of the individual steps or developments, the sum total of which makes up the history of progress. In order to include on these lists only items with which we are familiar, and also to keep their lengths so that we can go through them this evening, we limit this comparison to the last fifteen to twenty years.

I will read first the list of accomplishments of the automobile industry. Here we have had,

Improved body design and streamlining.
Lowering of center of gravity.
Improved spring suspension.
Closed cars.
Floating axles and knee action.
Four-wheel brakes; hydraulic brakes.
Free wheeling.
Safe and dependable tires.
Shatter-proof glass.
Lacquer paints; Pyroxylin paints.
Synchro-mesh gear shift.
Automatic cooling system control.
Down draft carburation.
Air filters.
Oil filters.
Better gasoline (high octane rating) permitting high compression ratios.
Elimination of unsaturated hydro-carbons which were the cause of sticky, gummy valves.
Elimination of starting trouble by oils with better pour tests.

So far, I haven't mentioned the major accomplishments of the automobile industry:

First, standardization of parts and mass production manufacturing methods. On this point the industry is unsurpassed.

Second, increase of nation's gasoline supply by the development of cracking, without which gas prices would have doubled or tripled.

Third, the construction of good roads. We cannot take full advantage of good cars on bad roads. The motor manufacturers have supplied the gasoline engines for the cement mixers, tractors and other machinery used in road-building, including the steam roller, but beyond that the credit for road building must go somewhere else.

Now let's see what we have to show for ourselves. We have included on the list of developments of the automobile manufacturer those made by the refiner and other associated industries, and therefore we are going to mention among the accomplishments of our industry those made with the collaboration of the dyestuff manufacturers.

Naturally the rayons will be included in this list. I don't think anybody will argue about their belonging there. Progress made in manufacturing and finishing plants includes the following developments:

Single process picking.
Long draft spinning.
High speed warper.
Slasher control.
High speed looms.
Mill humidification and conditioning.
Chainless mercerizer.
Better tenter frames and improved tenter clips.

New-type crepe dryer and new-type crepe washer.

Constant speed jigs.

We must also mention the great improvements in design which were made on all the machine units, such as mangles, squeezers, scutchers, padders, dyebecks, singers, dryers, etc., through the application of individual motor drives and automatic controls, ball bearings, enclosed gearing, improved methods of lubrication, and the use of new corrosion-resisting materials.

Then we have the condensation of individual processes into range operation, which has been carried out to a high degree in some mills, and has resulted in substantial lowering of costs. We continue the list with,

Peroxide bleaching.

Wet mercerizing.

Continuous boil-off of rayon, flat and crepe fabrics.

Use of new detergents.

Hexa meta phosphates.

Increased production through the use of wetting-out agents.

And now we come to the big guns:

Sanforizing.

Wrinkle-proofing.

The rise to practical importance of the Viscose, Acetate, cupro-ammonium and Nitrate Rayons.

The advent of spun rayon and all the new fabric development resulting from the blending of this fibre with cotton, wool, silk and linen.

The general introduction of the vat colors into the printing of dress goods and shirting, and the dyeing of shirting and bed-linen.

The indigosols and Rapidogen colors.

Our account of progress is surely as imposing as the list of the automobile industry, and, for that matter, of any other industry, and it follows that people charged with finding the trouble with the textile industry had better look for growing pains, rather than hardening of the arteries.

And now I want to dispel the fear that I am going to discuss all the items in our list. My friend Mr. Culver has asked me to speak to you for forty-five minutes to an hour, and I am going to take up a few items only.

At last year's meetings in this hall, we heard some excellent talks on some of the above subjects. Dr. Powers of Rohm & Haas spoke about wrinkle-proofing and resins, Mr. Borghetti of the Aspinook Company about continuous boil-off, Mr. Stott of Dupont about Acetate Yarns and Dyeing Acetates, and Mr. Bell of Calgon about Hexa meta phosphates. I could not add anything of interest on those subjects.

First, I would like to discuss

## HIGH SPEED WARPING

Warping is the operation in which a multitude of threads are wound upon the section beams, from where they go to the slashers, to make up the warps. In the old time warper, the yarns from the spinning frame bobbins were wound upon spools. A number of these spools, corresponding to the number of ends required on the section beam, are placed in a creel, and the ends are tied to the beam. The beam is made to rotate, and it unwinds the yarn from the spools, in the same way as I unwind it from this spool on the table. When the spools are empty, the machine must be stopped, the creel refilled, and the ends pieced together, before the warpers can be started up again.

The stopping for refilling cuts down production, and for this reason it is desirable to have large spools which run longer. However, as the size of the spools is increased, their weight goes up proportionately, and the strength of the thread is no longer sufficient to turn the spool. The number of broken ends thus increases.

The high speed warper has solved the problem very nicely. Instead of winding the yarn from the spinning frame bobbins on spools, it is wound on large cones. These cones are placed in the creels, and the yarn is pulled off over the end. In this manner, the tension on the yarn is cut to the minimum, and this permits running the warper with yarn speeds three to four times as high as the old machine would stand.

In addition, the machine does not have to be stopped for refilling the creels. When one of the cones is getting low, a full one is placed next to it in the creel. The end of the first one is tied to the beginning of the next, and when No. 1 is completely empty, the yarn simply starts unwinding from the full cone.

The high speed warper naturally is equipped with stop motion for broken ends and special motor drive and brake. Also a machine had to be developed in conjunction with the warper to wind the yarns on the cones. However, I am not going into details—I just wanted to describe the principle of the process.

Now I would like to discuss the progress made in the industry by

## LONG DRAFT SPINNING

Drafting is part of the manufacturing of yarns from staple stocks. In the making of yarns, you have a series of operations. First, you have the opening of the stock and formation of the laps, then the carding and the formation of the sliver. Once the sliver is formed, you have drafting, doubling and twisting operations in various sequences.

Drafting is always done by a series of pairs of rolls, in cotton manufacturing mostly three, sometimes four. The first one of these pairs turns slowly and feeds the stock to the machine; the next pair turns at a little higher speed; and the last is set at still a higher speed, and delivers the stock to the twisting operation.

The drafting operation is comparatively simple when the staple of the stock in process is uniform, as in the

case of spun rayon. Naturally, the distances between the nips of these roller pairs must be a little greater than the staple length, as otherwise the fibres would be torn in going through the machine. Yet with this condition fulfilled, all fibres are under full control of the drafting rollers.

On the other hand, when the stock contains fibres of various lengths, as in cotton and all other natural fibres, the matter becomes more involved. The distance between the nips must be set for the longest fibres. With such a set-up, some time will elapse between the instant the short fibres leave one nip and come under the control of the one following. The spinner calls this "The stock swims" between the rolls. It builds up there and comes through in bunches, causing uneven yarn.

For this reason, the conventional cotton speeders and spinning frames, for example, cannot run with drafting ratios over 1:10, and one must run several machines in series to get the total drafting required for the yarn to be made.

Long draft spinning adds one more element to the drafting rollers. In the Whitin-Casablanca system, for instance, you have two little aprons running over the middle rolls. These aprons keep the short fibres always under control while they pass from one nip to the next. However, the aprons do not hold the long fibres too tightly. They control the short and long fibres equally well. Therefore, drafting ratios of 1:20 and 1:24 are possible, and instead of having four steps from the doubler to the spinning frame, as was the case in old cotton mills, there are only two used with this system.

Here again, in the last few years, we have had a substantial lowering of cost which compares with almost anything the automobile industry has done.

Now I am going to talk about

## SANFORIZING

Sanforizing is a more involved process than high speed warping, and has gone through more stages to reach its present perfection. Nevertheless, Sanforizing is an invention of the same type as high speed warping or long draft spinning, and I like to call it a direct invention.

A man notices the shortcomings of a process or product. He decides to determine the causes of the shortcomings, and to try to eliminate them. By applying a lot of common sense and hard work, he succeeds, and in this way he advances the art.

We all remember how shirtings were finished before the advent of Sanforizing. The gray goods on their way through the finishing plant, were subjected to all kinds of pulling. To increase the pull on the cloth, extra pot-eyes were put up in the bleach-house to make the cloth travel zigzag fashion, and the washers were rigged up to give their share of tension. By this stretching, a hundred yards of gray goods gave 105 or more yards of finished material, and as the finisher in those days had to deliver gray yardage only, he had all the gain left to sell for his own account.

Goods finished in this fashion had a very undesirable property. Garments made up from them would shrink in the first few washings, so that it was necessary to buy shirts about a half to an inch larger than neck size. Mr. Sanford Cluett, of Cluett & Peabody, set out to remedy this condition.

He found that shirt collars shrank because the warp threads in the goods were in an unnatural condition. They were stretched and straight, and after the first washing, they would assume their natural crinkle and shrink correspondingly.

Cluett & Peabody then built their first pre-shrinking unit, a pin-tenter running in tandem with a palmer. The feed mechanism of the tenter is so construced that the cloth can be fed a little faster than the chain travels. This gives a slight pucker between the pins and the warp is without tension as the goods travel through the machine. The warp yarns therefore will assume the natural crinkled position and set that way. The palmer then gives the desired appearance and surface finish to the goods.

These first machines required a great deal of floor space, some of the pin tenters being ninety feet long. Cluett & Peabody pushed the work right along, and the Sanforizers of today are much smaller. For single-sided finishing, they consist simply of a quetch and palmer with a moistening chamber between. For double-sided finishing, the large palmer is followed by one about two-thirds its size.

I like to think of the newest Sanforizers not only as textile machines, but also as lie-detectors. Of course, as such they are not so dependable as they are in handling textiles, but then no lie-detector today is 100 per cent perfect.

Take a group of men, textile men if you wish, but people who haven't previously looked into Sanforizing or pre-shrinking. Bring these people into a textile mill where there is one of the newest Sanforizers in operation, and let them look around all they want to. Those who after a while say, "I don't see what makes the cloth shrink," tell the truth. Those who keep quiet don't dare to tell it.

The thing is so simple, almost like a parlor trick—practically everybody looks right over it. I have brought with me some cotton cloth and other paraphernalia, and I am going to give a demonstration of how the cloth is shrunk. I will ask those who know how the Sanforizer works to have patience.

I have here a piece of cotton cloth and a piece of cardboard, on both of which I have made two black marks to show the present length of the cloth. Here I have a piece of leather belt, which for this experiment has to take the place of the palmer blanket.

The palmer consists of a cylinder 5 feet in diameter,

or larger. At the feed end of the machine, the palmer blanket goes over a small roll and then follows the palmer cylinder around. When the blanket goes around the feed roll, the outside of it is stretched, and the inside is under compression. The cloth is laid on the blanket at a point where the outside fibres are fully elongated. Then as the blanket rolls onto the cylinder, it straightens out, and is bent slightly the other way, and the surface which was elongated first becomes slightly compressed. The cloth which was temporarily united with the blanket, is reduced in length in the same proportion as the outside layer of the blanket.

On the feed roll, there are a number of shoes all the way across the goods, and the function of the shoes is the same as that of the adhesive I use in my experiment. I am using gum arabic to unite the cloth with the belt, so that when I bend the belt back, the cloth will shrink without forming wrinkles. The same thing is done in practical Sanforizing by the shoes. They are heated and pressed down on the moistened cloth, and this causes the cloth and the blanket to unite temporarily.

At the point where the cloth first touches the palmer cylinder, it is shrunk, and it sets in that condition while it follows the cylinder around.

Turning back to the experiment,—after I have straightened the belt, you will note from the black marks that the cloth is very noticeably shrunk.

Now perhaps a few words about other methods of pre-shrinking are in order. It was but natural that people would try to pre-shrink fabrics without paying Cluett & Peabody a quarter or a half-cent royalty per yard.

The detour around the patent started by eliminating all unnecessary tension through the plant. By the way, this is also done where Sanforizers are used, in order to reduce the work the Sanforizer has to do.

In some schemes, the inventors tried to control the feed to the ordinary tenter frame. In another, a travelling apron is used ahead of the frame, where the cloth, saturated with the hot sizing, is given a chance to contract warp-wise. All these other shrinking methods produce a fabric which is distinctly superior to the old pulled cloth of pre-Sanforizing days, but I don't know whether any of them produces goods equal to the Sanforized product. I do not think there is any which can be controlled as neatly as Sanforizing, in which the speed of every part of the range can be varied in steps of about one-half per cent with respect to the main unit of the range.

When I was in Europe last summer, I noticed that the advertising campaign for Sanforizing had been successfully carried out over there. The public is becoming aware of what it can buy. During the last year, several finishing plants have installed Sanforizers, but, generally speaking, the European finisher has been slower in accepting pre-shrinking than his American colleague. This is only natural, because it is an American invention.

In one of the plants I had a conversation with one of the operators of the range, an old man whom I had known years ago. This fellow, who is quite a character, used to work in the silk industry in Lyons, France, and he took the attitude that there is nothing new under the sun. He told me that long before the war, they used the palmer for shrinking as well as finishing. In those days, he processed real silk linings for King this and Prince that, and this material had to be shrunk. I don't know how correct his statements were, possibly he was just reminiscing about a past which was to him still glorious.

Anyway, it doesn't make any difference as far as Cluett & Peabody are concerned. Theirs is the credit for having educated the cotton finisher in pre-shrinking, showing him how to use the palmer for this work, and vastly improving that machine for the purpose.

And now I want to discuss a development which I did not mention in our list, because it has not yet been completed. But the initial steps, which in this case are probably the most important ones, have been made, and the process, as far as it has been developed, has been in successful operation for several weeks.

I have in mind the

## WEFT STRAIGHTENER

or Filling Straightener, and I know that you will hear a lot about it this coming year.

We know how important it is to have straight filling for the printing of checker designs and handkerchiefs, and also for the manufacture of sheeting and pillow cases.

In fact, it would be quite desirable to have the filling perpendicular to the warp in all fabrics, even plain dyed shirtings and dress goods. However, unless he is forced to, the finisher will not exert himself to straighten the filling. It is not an easy job.

The Cranston Print Works, Winsor & Jerauld Mfg. Co. and the General Electric Company have joined forces in an effort to make crooked fillings a thing of the past. Some of the men connected with the work feel very sure that, by the time the 1940 presidential election rolls around, the textile industry will no longer need the adjective "crooked" in connection with filling, and they can let the politicians have full use of it.

Let us take a simple case, where the filling yarns are straight, but at an angle different from 90 degress to the warp. The Winsor & Jerauld Mfg. Co. has developed a differential gear drive for tenter frames, with which this condition can be corrected by the operator. With some push buttons, he can advance or retard one chain of the frame. When the fabrics are running at 80 to 120 yards per minute, it is very tiring on the eyes to watch it continuously, and consequently, the operator will use the buttons only to correct the worst places.

The next step in this development was the automatic

operation of the push buttons, but it was quite a problem to find a way in which this could be accomplished.

Some time ago, Mr. McKnight of Winsor & Jerauld Co. was looking at some movie film, and it was the sound track which caught his attention. There were different kinds of lines across the track, which caused the theatre loudspeaker to utter words, sing, or make any other kind of noise. Well, he thought, if the cross lines in the sound path do this, why can't the filling threads in the fabric be made to say, "get up" and "whoa" to one of the tenter chains.

And that is just what has been accomplished, only the cloth talks in a language that only the tenter can understand. It sound perhaps very easy now, but I want to tell you that the people who developed this had some real hard nuts to crack.

The problem resolved itself into using audio-frequency circuits for counting the number of filling threads near both selvedges as the cloth travels through the tenter frame.

In the latest machines, the control does not depend on the actual number of threads passing through the tenter. Under this arrangement, the operator would have to start the machine straight, and correct it occasionally, when through leakage in the amplification system, or otherwise, an unbalanced condition would be created.

The latest control units are fully automatic, and depend on their operation on the angle of the filling thread passing under the detector mechanisms. This angle is measured in an ingenious way by mounting a light source and a photo-electric cell on each side of the tenter. Rotating discs with slots in them for the passage of the light are placed between the cloth and the cells, the rotating mechanism being so chosen that the speed of rotation of the discs is always exactly proportional to the cloth speed. The electrical impulses thus emitted from the photo-tubes operate the previously mentioned push button contacts through an intricate hook-up of condensors and amplifying tubes.

So far the controls have been fully successful on plain weaves up to counts of 80 x 80, 136 x 60, and similar ones. On sateen weaves, some improvements may have to be worked out yet. On plain fabrics, 36 to 40 inches wide, the filling will not run out more than one-quarter inch from the 90 degree line across the warp. (The manufacturer today guarantees one-half inch.)

This equipment does not eliminate bowed filling, only makes it symmetrical. However, the bow can be corrected manually with an invention of the Cranston Print Works. On their machine, the bow is eliminated by a pair of rolls running at the delivery end of the tenter. The operator can, at wish run these rolls at the chain speed, or somewhat faster or slower. The top roll is of soft rubber, and has a crown, which touches only the center of the fabric. Thus this roller pair either pulls ahead or retards the center of the cloth, and thus corrects the bow. In the near future, trials will be made to hook this equipment up to a photo-electric cell, and operate it automatically.

Now I ask you to put yourself back about twenty years, and you will find that even such a short time ago, this development would have been inconceivable. It is way beyond your wildest dreams of those days. Even though it is not complete in every respect, I don't think there is any doubt that this is going to be one of the outstanding accomplishments of the industry.

So far I have presented everything in a favorable light for the textile industry, but in order to make this talk not too one-sided, I am going to take a different attitude in the last subject I am going to discuss, which is

## VAT COLOR AGING

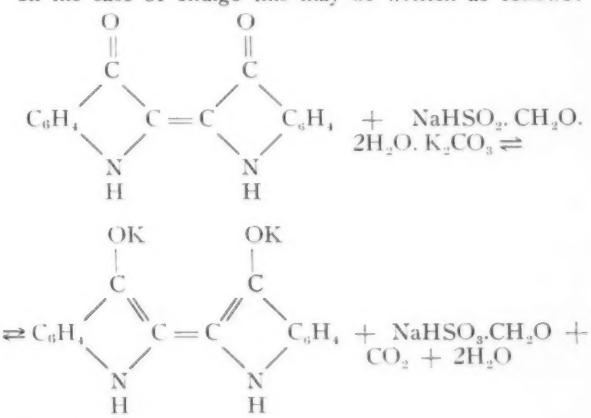
Sometime ago I was looking over some experiments which we made on aging, and I tried to find some relationship between some disconnected facts which I had before me. I decided to make a list of all the reactions which go on inside a Vat Ager. You have this list here on the board.

## MAIN REACTIONS

1*st. Reduction of Dyestuffs.*

Dyestuff + sodium sulfoxylate formaldehyde + alkali⇌ ⇄ alkali salt of leuco compound + oxidation products of sulfoxylate formaldehyde.

In the case of Indigo this may be written as follows:




2*nd. Local Dyeing.*

Cellulose + Alkali Salt of Leuco-Compound → in the presence of vehicle film result in

fixation through adsorption, addition or combination.

## SIDE REACTIONS

1*st. Condensation of Steam.*

Soluble Salts in print color film as Solid Solutions + Steam at 100° C. and atmospheric pressure → →dilution through condensation of steam + Heat.

*2nd. With Oxygen.*

$2NaHSO_2,\ COH_2,\ 2H_2O + O_2 = 2NaHSO_3,\ COH_2 +$ aq. + Heat.

*3rd. Destructive Reduction.*

Leuco-Compound + $NaHSO_2,\ COH_2,\ 2H_2O \rightarrow$ → Splitting of dyestuff molecule and destructive reduction.

*4th. Alkalinity Reactions.*

$NaHSO_3 + K_2CO_3 = K_2SO_3 + NaHCO_3$

$2NaHCO_3 = Na_2CO_3 + H_2O + CO_2$

As you see, the reactions can be classed under two headings—the Main Reactions and Side Reactions. There are two main reactions, first, the reduction of the dyestuffs, and second, the local dyeing. The side reactions are more numerous.

We have the condensation of steam on the soluble salts present in the print color film as concentrated solid solutions (of microscopic crystals). This results in the dilution of these solutions with the emission of heat. Then, there is the action of oxygen in the ager with the "hydro," and that also gives off considerable heat. Third. we have the destructive reduction of the dyestuff and the breaking up of the leuco-molecules by an excess of sulfoxylate. And last, I mention the various alkalinity reactions or reactions which affect the pH in the color film.

In the past, several men have tried to improve agers by making provisions for the dissipation of the superheat generated when vat prints are aged. Now if we look at the above list, we find that the main aging reactions do not give off any heat. The reduction of dyestuffs is slightly endothermic, and local dyeing takes place without liberation or absorption of heat. Expressed somewhat differently, the important reactions through which the dyestuffs are fixed are not the cause of the superheat. Therefore it appears that we might get further in improving aging and the color yield if we stop the side reactions in the first place, instead of letting them go on and then dissipating the heat generated by them.

In order to better understand this complex ager reaction, I decided to calculate the maximum temperature which we are likely to encounter in the print color film during aging. Some of you may say, we know that temperature —we have put thermometers in the agers. A reading thus obtained might be considerably lower than the film temperature. This becomes evident when you remember that in the ager the printed portion of the goods becomes the heat radiating surface, and nobody would try to determine the temperature of a steam radiator by hanging a thermometer in the room, or even between its sections.

In an effort to determine the maximum temperature which might exist in the film due to side reaction No. 1, I went through the various tables of physical and chemical constants, but found nothing I could use. In order to get an indication of what we have to expect, I made some preliminary experiments, and I found that the maximum temperature due to this source of heat is about 260° F. if the formula contains potash, and sulfoxylate, and 235° F. if the color is made with soda ash and sulfoxylate.

Next, I wanted to calculate the maximum temperature which might be reached in the film through the heat generated by side reaction No. 2. For this I needed to know the number of calories or B. t. u.'s developed by the oxidation of the sodium sulfoxylate, but again I could find no data recorded in the literature. If it ever was determined, it has not been published. The only information I found was the heat of reaction of hydrosulfite with oxygen, which was determined in 1876 by Berthelot in Paris. Since then no quantitative work has been done on these reactions.

It appears that the textile industry has been using millions of dollars' worth of dyestuffs and chemicals in vat printing and never bothered to determine the physical and chemical constants which control the result of the processes in which these materials are used. I don't think it serves to its credit.

In closing, I would like to ask you a question. When you look at the inventions which come from Europe to America, you will find that the proportion of chemical inventions is higher than the proportion of mechanical inventions. On the other hand, if you look at the inventions brought from America to Europe, there are more mechanical inventions than chemical inventions. The question I would like to ask is this: "Is this caused by the difference in conditions in America, or by a difference in the mentality of the Americans, or by a difference in the educational systems of the two countries?" I would be very much pleased to hear the opinion of anybody on the subject, either tonight or at some future meeting.

## DISCUSSION

*Q.* You have mentioned Europe and America in regard to aging. Did they find a reason in Europe for that reaction which must be just the same over there?

*A.* I don't think I understand the question. There is no reason for any reaction.

*Q.* Is the ager reaction a thing which you can control?

*A.* Yes, I think you can control aging. That is why I brought it up today, and why I discussed it when Mr. Tattersall spoke here a year ago. He described various ways of dissipating superheat which reduced the color yield. I wanted to show today that the main reactions in the ager do not create the heat. The undesirable thing comes from side reactions. You can control those side reactions, e. g., you can control the amount of oxygen which gets into an ager. I may be able to discuss this at a time when this talk is put in your paper. You can also replace the potash by soda ash, and reduce the temperature, and that is what some dyestuff companies recommend for dyes of the indigoid type.

The following dyestuffs, for example, give better color yield with soda ash, all being of the indigoid type, notwithstanding the names of the first two:

Indanthren Red Violet R H A
Indanthren Brilliant Pink R A
Algol Scarlet G G N A
Brilliant Indigo 4 B

The explanation for this is very simple, on the basis of the list of the ager reactions. Indigoid type dyestuffs are comparatively easily over-reduced in the ager, and the higher the temperature, the faster the destructive reduction goes on. With soda ash in the color paste, the film temperature is materially lower than with potash, hence you have less over-reduction and better color yield.

*Q.* I would like to have the Doctor elaborate on his question at the end of the discourse. What did you mean, was it the educational system or the mentality?

*A.* I was hoping somebody else would first voice an opinion on that subject. I am not a psychologist. I don't want to say whether the mentality has anything to do with it. I thought the educational system over there had some influence. I am a graduate of the Swiss Federal Institute of Technology in Zurich, and that's the school I know best. But I believe what I say applies to some degree to other universities as well. At the Institute, we always had in the organic chemistry department a combination of two men, one a scholar and scientist (Willstadter, later Staudinger) and the other an industrial chemist who had been in the Textile and the Dyestuff Industries (Ceresole, later Fierz-David). This happy combination of men made for close cooperation between the industries and the School, and brought the industries' problems before men who were primarily scientists, and before the students doing graduate work.

I don't think such favorable conditions as are illustrated by this example have existed in the States, at least not as early as in Europe.

*Q.* Is it a fact that we might be running a little less economically in some cases because we are running faster? The European plants are not so much concerned with producing as we are. We are traveling faster, and sacrifice a little in the way of color value to get out production. The Europeans take more time. In the long run, we may find the method which will give us more production and the efficiency they get over there.

*A.* It's quite possible.

*Q.* Is the average production much lower in Europe than over here?

*A.* True all around. In Europe, production is always of secondary importance as compared to American mills. I was in one place, which, according to our American system, I would expect to put out about five or six million yards a month, but I was told they put out just one million yards a month. I asked how many different fabrics or different styles they handled, and was told that they had eighty different fabrics and different styles. One mill tries to handle everything. Over here production is of prime importance. Over there production is not so important, because labor is lower.

*Q.* The point of view of the technical man in the plant in Europe is different from the point of view of the technical man over here. He does not have to consider production to the same extent as we do. Our fabrics will be less expensive, and we will be creating more wealth through more production.

*A.* I think you are right in saying you are outstripping them in production.

*Q.* I understand that the quality of our prints is superior to some of those turned out in Europe.

*A.* I don't know. I think when it comes to quality, the Europeans can always match the American manufacturer. I brought back with me some scarfs, and showed them to some friends of mine in the printing business, and they said, "We can't do that. If we could run slower, we would be able to." I am surprised you find European prints not equal to ours. They can run slower. We cannot. I think they are always able to equal or do a little better than the American manufacturer.

*Q.* In connection with the second reaction in the ager, I had occasion while in Germany to see a separate compartment. I wonder if anybody ever thought of putting the reducing agent in there.

*A.* That may be one way out. Over there, agers are somewhat different from over here.

*Q.* Since it is impossible to eliminate the heat in the side reactions, has any attempt been made to counteract the heat by the addition of salts, like borax or urea?

*A.* It has been done, but to my knowledge it hasn't been been successful.

*Q.* I don't like to be persistent, but I should like to know whether you think it is a difference in mentality or the conditions which are responsible for our backwardness in chemical inventions. Do you think it is the educational system?

*A.* The educational system no doubt has something to do with it. How much influence this has, I don't know. Naturally, conditions as a whole have something to do with it. The dyestuff industry took root over there long before it did over here. The cooperation in Europe of the men in the dyestuff industry and those in the textile plants with the chemical staffs of the universities has no doubt been beneficial. In America this cooperation has just started in the past few years, and I don't think it is fully developed as yet.

*Q.* You spoke of lower costs in Europe. Is it also true that the cost of training technical men is much lower than over here? Possibly the cost of technical developments is lower in Europe due to this condition.

*A.* It used to be that way, but conditions over there have changed drastically during the last few years, and I am not prepared to say what they are at present.

*Q.* You said they are making more progress in Europe as far as inventions go? I doubt if this is correct.

*A.* You must have misunderstood me. In chemical work, yes, Europe is ahead, but I thought I was very positive in stating that, when it comes to mechanical developments, the Americans are superior to the Europeans. We have the Sanforizer, and I have described the filling straightener, which are outstanding, and go from America to Europe. My question was, why is it that America has more mechanical and Europe more chemical developments? In mechanical developments, America is leading, and in chemical developments, Europe is leading.

*Q.* How did that man in Europe say he shrunk silk?

*A.* I don't know how he did. He insisted that they made linings in those days which had to be unshrinkable. They had to put it in coats for the nobility and it had to be unshrinkable. How correct he was, I do not know, and how he did it I do not know either. I have heard from other people of the palmer being used for shrinking as well as for finishing in years gone by. You cannot use the ordinary palmer, because if you do not have the shoes, you cannot unite the cloth with the blanket. The amount of shrinkage you can get with the palmer without the shoes is very limited.

*Q.* Does Cluett & Peabody use a special size?

*A.* I do not think so.

## The Saponification of

# Acetate Rayon*

J. E. MEILI

SEVERAL of our members have asked me to have someone give a lecture on the saponification of Acetate. I have tried very hard to find a good speaker on the subject and not finding any, I decided to take it on myself.

Many of you will remember the difficulty we have met in the dyeing of acetate in the early 20's when acetate was first brought on the market. We all tried saponification at that time, mostly with disastrous results. I was then working with bright acetate yarns and with acetate satins. Acetate crepes were not known at that time. Today we are dealing principally with acetate rayon crepes and many mills are turning out saponified acetates that are almost passable for plain goods and are entirely satisfactory for prints.

Before going any further, I wish to explain to those who are not familiar with the subject, what saponification means. Acetate rayon is like the other rayons in common use made either from cotton or wood pulp, but while the other rayons like viscose, bemberg and chardonet, in their finished state are regenerated cellulose, the acetate rayon remains as a chemical compound of cellulose and acetic acid, in which the cellulose molecule acting as alcohol, is combined with several acetyl groups. Such compounds of alcohol and acid are called esters. The hydrolysis of an ester into its components is called saponification. Saponification therefore is a chemical process and is not to be confounded with dulling of the acetate which is a strictly physical process.

If in an acetate yarn all the acetyl groups were split off, which can readily be accomplished by treatment with an excess of alkali, we would obtain a product with properties somewhat resembling an inferior grade of nitro silk, and a 100 denier acetate fiber would be reduced to a 60 denier fiber. But if the saponification is only a partial one, if it is conducted in such a way that the hydrolysis takes place principally and evenly on the surface of the fiber, we generate a new fiber that retains many of the characteristics, especially the plasticity and the softness of the acetate silk, and at the same time has the dyeing quality of viscose and can be dyed with direct or developed dyestuffs and can be printed with Vat dyestuffs by the regular dyeing and printing formulas used for viscose-rayon.

We have of course today, no further need of saponification for the dyeing of acetate for plain goods. There are a large number of excellent specific acetate dyestuffs on the market which make the dyeing of acetate as simple as the dyeing of the other rayons. However, there has existed for a long time, a demand for acetate prints and the discharge printing of acetate is still offering serious difficulties. Of the acetate dyestuffs, there are a large number that can be discharged to a perfect white. I have a few samples here showing discharges of Artisil Direct

*Presented at meeting, New York Section, Jan. 29, 1937.
†Sandoz Chemical Works, Inc.

Colors on acetate satin. The discharge was made with a paste containing:

20% Arostit ZET which is Zinc Sulfoxylate
5% Dietheylene Glycol
75% Gum and Water

Quite satisfactory discharges can thus be obtained on all acetate goods, but it is almost impossible to obtain a good white on acetate-rayon crepe.

There exists a large number of patents giving different formulas for acetate discharge. I have tried out each and every one that I have come across but none gave better results than the formula that I have mentioned.

As the dyestuff manufacturers and chemists were not able to furnish readily dischargeable dyestuffs nor a working formula for existing dyestuffs, the dyers themselves found a way to overcome the difficulty and this is by the method of saponification.

Saponification can be carried on and is being carried on in several different ways, and each will give satisfactory results if properly conducted. The medium of saponification is of course always an alkali, although hydrolysis can also be induced by treatment with certain mineral acids.

The alkalies with which I have been working are:

Caustic Soda,
Sodium Carbonate and
Trisodium Phosphate.

To obtain the same degree of saponification they have to be employed practically in proportion to their molecular weight; thus:

10 parts Caustic Soda compares with 26½ parts anhydrous sodium carbonate and
95 parts Trisodium Phosphate.

The speed of reaction is dependent on the concentration and the temperature. Sodium Carbonate reacts by far the slowest.

Samples treated with 26 per cent soda ash showed in 1½ hours time a loss of 3.2 per cent at 130° and 9.3 per cent at 180°. With 10 per cent caustic soda in a volume of 1/30 the reaction was 92 per cent complete at the end of 1 hour at 120° F. and at 180° the caustic soda was completely neutralized at the end of 20 minutes. An addition of Glauber salt or common salt to the saponification liquor increases the speed of reaction while an addition of sodium acetate decreases it to some extent.

In practical work it is of greatest importance that the goods are evenly saponified, that the saponification takes place principally on the surface, and that the saponified acetate shall have approximately the same affinity for direct dyestuffs as the viscose fiber. To save time, it would be advisable to run the saponification at an elevated temperature. Even results, however, at a high temperature, can only be obtained if the reaction is slowed down. This can be done by making the addition of the alkali in several small portions. But when we examine dyed samples that were saponified to the same degree at different temperatures, we find greatly varying results. At a low temperature the fiber is hydrolized from the surface while at a higher temperature due to the swelling of the fiber, the alkali can penetrate deeper and we obtain a partially saponified acetate that has considerably less affinity for direct dyestuffs. Here are four samples saponified with 8 per cent caustic soda; two treated with the full amount of caustic soda for 1½ hours at 100° F. and 120° respectively, and then heated for 10 minutes to 150° and the third treated at 150° and the fourth at 180° F. adding the caustic soda in 10 portions at intervals of 10 minutes.

The loss of weight of the four samples is practically the same. They were dyed in the same bath with 4% Diazamine Blue BR. You can notice that the shade gradually becomes lighter with the increase in temperature and on closer examination you will find that in the first sample the acetate is darker than the rayon, in the second the two fibers are approximately of even shade, while in the third and especially the fourth sample, the viscose is much darker than the acetate.

According to these and other experiments satisfactory results can be obtained by treating the goods with 5-10 per cent caustic soda for ½ to 1½ hours at 120° F. and then raising the temperature slowly until the end of the reaction is reached.

By using sodium carbonate or trisodium phosphate, the same procedure can be employed. As the saponification with sodium carbonate proceeds rather slowly at low temperatures, the reaction will take place to the largest extent at a higher temperature and samples saponified with sodium carbonate by this method will always dye up lighter than those saponified to the same degree either with caustic soda or trisodium phosphate. This is illustrated by these three samples—

1. Saponified with 26 per cent soda ash
2. With 10 per cent caustic soda
3. With 75 per cent trisodium phosphate.

The volume in all three tests was 1/60 and 20 per cent Calc. Glauber salt was added to each at the beginning. After keeping the temperature for 1½ hrs. at 120° the dyestuff (4 per cent Diazamine Blue BR) was added to each, and the temperature was raised to 195° and the dyeing continued for 1¼ hrs. The sample saponified with sodium carbonate lost 9.7 per cent and is by far the lightest. The one saponified with sodium hydroxide lost 10.8 per cent. The sample saponified with Trisodium Phosphate is the darkest although it lost but 8.2 per cent. This test speaks in favor of trisodium phosphate as the best suited alkali.

It is of course most natural that the appearance and the strength of the crepe will be the least altered the lower the loss in weight. The saponification naturally weakens the fabric considerably and this almost in proportion to the degree of saponification. Thus I found in one instance that a 6 per cent saponification showed a loss in tensile

strength of 8 per cent, a 9 per cent saponification of 12 per cent and a 13 per cent saponification of 18 per cent. These measurements refer naturally to the acetate warp. The strength of the viscose filling was not affected. I am speaking here of 6, 9 and 13 per cent saponification, meaning a loss in weight of 6, 9 and 13 per cent respectively. This expression is commonly used but is of course incorrect. A 13 per cent loss in weight represents roughly a 52 per cent saponification figuring on a crepe containing 50 per cent Acetate of a 50 per cent Acetic acid content.

The dyeing of the saponified crepe offers no serious difficulty. It is advisable, however, to select level dyeing dyestuffs as they, to some extent, at least cover up inequalities of the saponification. The best white discharges are obtained with dyestuffs that leave unchanged acetate as white as possible. Care must also be taken in developing that no large excess of Beta Naphthol is employed as this may cause a more or less yellowish discharge. I found that ¾ per cent of Beta Naphthol gives good results with regard to shade and to discharge. I have two samples here, one developed with ¾ per cent Beta Naphthol is whiter than the one developed with 1½ per cent Beta Naphthol. The dyeing can be carried on in a separate bath or directly and with most dyestuffs even advantageously in the saponification liquor. If in dyeing one finds insufficient affinity of the acetate fiber then it is advisable to make additions of trisodium phosphate to the dyebath. Such additions will also have good leveling effects. These samples here show some of the dyestuffs that are suitable for this kind of work. (Discharge samples of diazamine and viscoform colors on saponified acetate were passed around.)

By means of saponification we can thus obtain prints that are quite satisfactory. On entering this room I was handed this print of saponified acetate. I do not know whether I am permitted to disclose its origin but it certainly is a most excellent piece of work, and illustrates what can be accomplished with saponified acetates. Nevertheless saponification will always remain a makeshift and will be discarded as soon as printing of the unchanged acetate becomes feasible.

## DISCUSSION

*Chairman Baxter*: I am sure we enjoyed Dr. Meili's speech and I am also sure that we are going to have a lot of questions.

*Mr. Goldberg*: I would like to know whether you paid any particular attention to the difference in hand after saponification—that is, whether you noticed enough difference so that you still retained the advantages of having an acetate warp crepe rather than an all-rayon crepe.

*Dr. Meili*: Yes, I paid much attention to that. Although I have really been more or less recommending caustic soda as a means of saponification, I did that only because it is the cheapest. Trisodium phosphate comes considerably higher, as the amount to be employed is much larger. But I found when I took large samples, and saponified them to the same extent with trisodium phosphate or caustic soda, that the trisodium phosphate sample had the nicer hand. And with trisodium phosphate you can saponify considerably less and still have good dyeing qualities.

*Mr. Dogan*: Dr. Meili, there is a tendency in dyeing the saponified cloth on the market now to dye the acetate much darker than the rayon. You mentioned that the addition of trisodium phosphate levels and overcomes this trouble. Does that apply to browns?

*Dr. Meili*: You misunderstood me, evidently. If the acetate is dyed lighter then the addition of trisodium phosphate is advisable, but if the acetate is dyed darker, then the only way out of the difficulty is to select different dyestuffs. You have certain dyestuffs that dye the acetate much more than the rayon; and you can select other dyestuffs which dye very evenly, even if the acetate is saponified to quite a large extent.

*Mr. Dogan*: For instance, in a brown, brown is usually made up with a mixture of orange, blue and red. The orange is the one that causes the trouble. There are not very many oranges that dye the rayon and saponified acetate the same shade.

*Dr. Meili*: That depends on your method of saponification. If you saponify at a high temperature, acetate will be dyed less than the viscose.

*Mr. Dogan*: Therefore, it is a question more of temperature than of dyestuffs.

*Dr. Meili*: I would not say that. I have here some samples. In making the dyeings, I found certain dyestuffs that would not dye the viscose; even in pieces that were but slightly saponified, while other dyestuffs gave perfect penetration.

*Mr. Barbour*: Dr. Meili, in your saponification of acetate yarn, without mentioning the name of the maker, do you find, on the reactions of the various acetate yarns on the market, that they all react the same way to your treatment?

*Dr. Meili*: In saponification this is almost generally the case. For other treatments you may find large differences. I remember cases of cross-dyeing acetate rayon goods. Certain qualities could be given a boiling soap or say a soap at 170 degrees F. and would cross dye perfectly. With the proper dyestuff the acetate would stay perfectly white, while other qualities given the same treatment, even perhaps in the same bath, would show the acetate considerably tinted, indicating the beginning of saponification. But in the saponification bath, where you saponify 30-80 per cent, a slight difference in the speed of reaction is of little importance, and would hardly make any difference in the final appearance of the goods. It does make a difference, however, if the goods are intended for cross-

dyeing. It also may show up if different qualities are saponified and dyed together.

*Mr. Dogan*: I just noticed on your card for distribution where you have a number of dyestuffs discharged here. You have your Viscoform Navy Blue GB, and Diazamine Blue BR. I presume Viscoform Navy Blue GB is a blue-black type.

*Dr. Meili*: It is.

*Mr. Dogan*: Have you noticed any particular qualities of the color in connection with Viscoform Navy Blue GB as against Diazamine Blue BR, and also the dyeing of plain rayon. Does it alter the qualities of the color? And does it make it any faster for washing?

*Dr. Meili*: The Diazamine Blue BR developed is, of course, faster to washing than the Viscoform Navy Blue GB. But the Viscoform Navy Blue GB is sufficiently fast for most printers, and that is all that counts. You can run prints with regular direct dyestuffs. As long as it passes the print shop, you will not have any complaint afterward from the trade.

Viscoform Blue GB is not as good leveling a dyestuff as the Diazamine Blue BR. Diazamine Blue BR will penetrate much more readily than the Viscoform Navy Blue GB. However, the Diazamine Blue has to be developed, and the other one does not.

*Mr. Dogan*: Are the washing properties any different on saponified acetate than on regular rayon? Usually it would stand 130° Fahrenheit on regular rayon.

*Dr. Meili*: I have made some wash tests but not carefully enough. According to the tests I made it is sufficiently fast for printing. I do not have any doubt that it was just as fast as on rayon, but I could not tell you.

*Mr. Lascara*: Do you recommend the addition of common salt or sodium sulfate in the converting bath, to preserve the weight of the material?

*Dr. Meili*: No, that has nothing at all to do with the weight of the material. Although I have used it in some of my experiments I do not recommend it, though I don't think it makes much difference whether it is put in or not. On a large scale I would not put it in. I would put in the dyestuff first and the salt afterward. This is more advisable.

*Mr. Lascara*: And would you add any common salt or sodium sulfate in dyeing—in the beginning—or would you first allow the material to be penetrated? I mention that for the purpose of dyeing the rayon deeper than the acetate.

*Dr. Meili*: You can always dye the rayon deeper than the acetate, if you want to. As a rule you want them dyed to about the same extent.

Now, if you run your saponification in such a way that the acetate will take up more dyestuff than the viscose, and if you dye the viscose first by adding salt from the start, the dyestuff will afterwards in the hot dye bath go on the acetate. But satisfactory results can be obtained both ways. I ran many samples adding the salt first, and they came out entirely satisfactory. And when I ran them the other way, they came out satisfactory, too.

*Mr. Uzunoff*: Dr. Meili, can you tell me if you have noticed any appreciable delustering effect on the acetate after saponifying it with those three alkalies you mentioned—caustic soda, sodium carbonate, and trisodium phosphate.

Another thing: Would saponification in a very high degree improve the property or the affinity of the acetate fabric to take up more finish?

*Dr. Meili*: Well, I have not made any study of the finishing of the fabric, but as the saponified acetate will take on moisture much more readily, absorb moisture into the fiber, it naturally should take on finishes more readily than the acetate which does not absorb any moisture.

*Mr. Uzunoff*: What about the luster, please?

*Dr. Meili*: As to luster, you can saponify lustrous acetate and keep it lustrous. The saponification has nothing to do with the delustering. In the acetate crepes, of course, you deal always with the delustered acetate. And not much attention is being paid to whether it gets a trifle more lustrous or not. You of course are aware that dark shades are always more lustrous than light shades. The pigment is covered up by the dark coloring.

*Mr. Uzunoff*: Would saponification of acetate fabric eliminate crush marks? I mean, one usually applies a small amount of oil to an acetate fabric, and crushes it. Wherever the fabric has been crushed it leaves a pale or a dark mark.

*Dr. Meili*: I am not able to answer that, but I should think it would help to a certain extent.

*Dr. Smith*: Are the losses in weights which you gave based on the fabric as a whole or the acetate warp only?

*Dr. Meili*: The fabric as a whole.

*Dr. Smith*: So it would be double the loss of the weight of the warp? What is the average loss?

*Dr. Meili*: Practically double—yes. As for the goods in the trade, I picked out quite a few samples and examined them. I found some which were completely saponified. The samples of crepes mostly used will lose 24 per cent on complete saponification; and some samples that I have examined are absolutely and completely saponified. Others had lost about 17 per cent and still others 15 per cent. I would say most of the samples in the trade are saponified between 10 and 12 per cent—probably nearer 12 per cent. You probably can tell us more about it. Dr. Smith, I think you have examined more samples than I have and probably can give us a better idea.

*Dr. Smith*: Not nearly as many as I would like. The ones we have examined we have taken the warp yarns out and made a denier test of and we have had to assume the original denier was as specified. We have found that

on a 100 denier yarn the denier will come out anywhere from 85 down to 75. And if you allow four or five per cent for the natural finishing loss, we estimate that the actual saponification varies from 10 per cent to 25 per cent or 30 per cent in fairly extreme cases. But we would like to know what more to do about it.

*Mr. Staab*: For printing with fast colors, Doctor, would you recommend partial saponification or complete saponification of acetate yarns?

*Dr. Meili*: The partially saponified acetate can be printed quite satisfactorily with Vat Colors. In fact, you can print unsaponified acetate very successfully with Vat Colors.

*Mr. Baumann*: On one of your cards you have dyed goods in the saponification bath. Does that mean you put the dye in, in the beginning?

*Dr. Meili*: I mentioned before, that I put the dyestuff in after the goods had been in for an hour and a half.

*Mr. Baumann*: Don't you carry the saponification a lot further by dyeing it in the alkaline bath?

*Dr. Meili*: After your soda is used up you have no further saponification. When you work with caustic soda, the bath will be completely neutralized by the time it reaches 150° F.

*Dr. Smith*: Dr. Harold pointed out one complication on the loss of weight, which is, that as you saponify you increase your moisture so that your per cent loss of weight is not equal to the per cent of acetyl removal. I don't think anybody yet has worked much on the thing from the standpoint of the analysis of residual acetyl content, but what you are actually measuring when you measure loss of weight is something less than the amount of acetylation.

*Dr. Meili*: That is correct, Doctor. Thank you.

*Dr. Harold*: You mentioned that even with a smaller amount of loss of the acetyl radical with the phosphate treatment you have a greater affinity for dyestuff. Have you any explanation to offer as to why, when sodium phosphate reduces the acetate radical in less amount, still it attracts more dye?

*Dr. Meili*: Well, I only can give you my opinion. I really do not know. Sodium phosphate does not react as fast as caustic soda. So, by the same treatment, the reaction will take place at a somewhat higher temperature with phosphate than with caustic soda. Nevertheless, the dyeing will be darker.

I have thought about that point too, and I explained it to myself, without having any proof for my statement, this way: that the large molecule of trisodium phosphate probably prevents to a certain extent the penetration. You have much more surface saponification, and this is most likely due to the large molecule which enters into the reaction.

## ANNUAL MEETING, MID-WEST SECTION

THE Annual Meeting of the Mid-West Section was held Saturday, February 27th, at the Bismarck Hotel, Chicago, Illinois.

Preceding the meeting there was a Round Table discussion over which Mr. Herman Boxser, of Western Felt Works, presided. This meeting was well attended and because of interest shown in various problems under discussion, it was agreed that the Association should hold similar meetings in the future.

Dinner was served at 7:30 P. M., 109 members and guests being present. Mr. Don Purdy, Chemist at Tuttle Press Company, Appleton, Wisconsin, amazed and mystified the textile chemists by an exhibition illustrating the wonders of magic.

The annual report of the Secretary for 1936, which included the minutes of the previous meeting and the Treasurer's report for 1936, was then read and approved.

Chairman Brainerd then turned the meeting over to Mr. Joseph F. Feit, Vice-Chairman, who called upon Mr. Clarence W. Willie, Chairman of the Nominating Committee, for report on nominations for election of officers. Mr. Willie announced that his Committee also included the following: Charles E. Maher, John Petty, Erwin J. Sindt and H. D. Boswell. Mr. Willie then announced the names of the candidates selected by his Committee, all of whom were then unanimously elected to office:

Chairman—Edward J. Siegrist.
Vice-Chairman—Paul Willgeroth.
Treasurer—George A. Warburton.
Secretary—Herbert W. Tetzlaff.
Members of Section Committee—Arthur T. Brainerd, Elias A. Johnson, G. R. Kremers, Gilbert T. Latham.
Representative to the National Council—Elmer F. Smith.
Representative to the National Nominating Committee—Joseph F. Feit.

Members were then advised of the death of Mr. John Miller, Lacon, Illinois, and the Secretary was delegated to draw up a resolution in behalf of the Section, expressing to Mrs. John Miller the esteem in which Mr. Miller was held by his fellow members. The Secretary was also authorized to make arrangements for appropriate floral tribute.

The meeting was then addressed by Dr. L. Arnold, of E. I. du Pont de Nemours & Co., Wilmington, Delaware, who spoke on the subject of "Textile Finishes and Their Application," which the members found a very interesting subject.

There being no further business, the meeting was adjourned at 10:05 P. M.

Respectfully submitted,
HERBERT W. TETZLAFF, *Secretary.*

# TEXTILE CHEMICAL SPECIALTIES

AGAIN the American Association of Textile Chemists and Colorists is preparing a list of textile chemical specialties for publication in our Year Book. It is the purpose of the Association not only to make conveniently available for its members a list of the chemical products which can be purchased in the American market for the processing of textile materials, but also to disclose the chemical nature of those products so that the chemist can use them with greater understanding. Since the list is published in the interest of our members for their information, there is no charge to the manufacturer or importer for the listing of products.

The policy expressed in the original resolution of the Council authorizing this department has been followed again: namely, that "The list of products for textile processing shall be limited to homogeneous substances for which the chemical formula or complete qualitative composition or method of manufacture is given by the seller." Generally speaking, only products with proprietary names or specific textile uses have been included. But even then, many products which are widely used in the textile industry at great economy and with much advantage, such as sulfonated oils, soaps and many other products, have not been included because they are so common that listing would have no particular instructional value and their great number would make the list too long. Furthermore, there are many meritorious products on the market with secret compositions of which the disclosure would invite unfair competition since they can not be protected by patent. For these reasons, the omission of a product from the list must not, under any circumstances, be taken as a reflection upon its usefulness in a textile mill.

The chemist using the tables must remember that the information given concerning the various specialties with respect to uses and composition is obtained mostly from the firms offering them for sale and cannot be vouched for by the committee. The value of a textile specialty for a given purpose must be determined on its own merits since the committee merely repeats information which it feels reasonably certain is true. The listing of a product for a specific purpose implies no guarantee on our part of the practical usefulness of the product for the purpose indicated.

The committee earnestly solicits the cooperation of all manufacturers and importers for the improvement of this authentic list of chemical specialties available in America for the processing of textile materials. Those who have not participated thus far in the work are invited to send the necessary information at once to the Chairman for inclusion in the next Year Book. This information should be tabulated as follows:

1. Firm abbreviation, limited to four letters and conforming to, or not interfering with, the abbreviations used in the Tabulation of American Dyes.
2. Proprietary or trade name under which the chemical specialty is sold.
3. Principal uses, very briefly.
4. Chemical nature:
   (a) Systematic chemical name or chemical formula, if an essentially pure substance; or
   (b) Complete qualitative composition, if a mixture; or
   (c) Method of manufacture, very briefly, with names of raw materials.

CARL Z. DRAVES, *Year Book Committee.*
273 Converse Street, Longmeadow, Mass.

## ONE HUNDRED AND ELEVENTH COUNCIL MEETING

THE Council held its 111th meeting at the Engineers' Club in Boston, on Friday morning and afternoon, February 5, 1937. Present were President William H. Cady presiding; J. C. Hayes, representing the Treasurer; Louis A. Olney, Chairman of the Research Committee; Harold M. Chase, Carl Z. Draves, Henry F. Herrmann, and Arthur E. Hirst, Councilors-at-Large; Hans Meyer, R. M. Ritter, and Ben Verity, representing New York, Philadelphia and Rhode Island; and Harold C. Chapin, Secretary. The Treasurer's report of February 5, and the Secretary's balance sheet attached hereto, were accepted. Receipts under all headings of the latter were shown to be ahead of March 5 in the preceding year.

It was voted that the next Annual Meeting be in the Bellevue Stratford Hotel, in Philadelphia, on December 3 and 4; that the next Council meeting be in the King Cotton Hotel, in Greensboro, N. C., on Saturday, April 17, at 9 A. M.; and that the next succeeding Council meeting be in New York on Friday, June 11, at 10 A. M.

Ballots received to date on the proposed amendments to the Constitution presented at the last Annual Meeting were counted, and found decisively in favor of the amendments. Possibilities of further revision were discussed. To make recommendations to this end the President appointed as a committee H. C. Chapin, C. Z. Draves, J. C. Hayes, W. R. Moorhouse and W. M. Scott. It was voted that hereafter $1.50 out of each $5.00 application fee paid by a member elected after May 1, be credited toward dues of that member in the next fiscal year.

Each of the following was elected to the class of membership specified, as of thirty days from publication of application, provided no objection be received meanwhile by the Secretary:

### *Active*

| | | | | |
|---|---|---|---|---|
| J. E. Allen | H. A. Gallagher | B. H. Little | V. C. Rogers | R. B. Taylorson |
| E. H. Aspinwall | H. J. Gambert | Joseph Lucca | A. N. Scaccia | Leon Therrien |
| G. A. Billingsley | A. F. V. Hiller | J. E. MacDougall | K. T. Schaefer | Curt Tjorn |
| A. J. Bisbee | C. M. Howard | G. M. Mackenzie | C. H. Schofield | H. A. Turley |
| I. L. Blackmer | R. H. Humbaugh | Albert McDowell | Max Schuster | Mark Weisberg |
| Fred. Bonnet | R. V. Irwin | T. H. McKay | C. F. E. Sedgwick | H. A. Whitenight |
| Ernest Burrell | A. O. Johnson | A. E. Mitchell | Cyril Smith | R. C. Whitney |
| J. E. Conrad | G. C. Jones | L. A. Oberly | Meyer Sperber | F. E. Wilson |
| W. F. Fancourt, Jr. | J. A. Kidd | J. W. Orelup | W. W. Stapler | H. R. Zinn |
| Adam Fisher, Jr. | J. A. Kilcommons | Louis Postal | Wallace Taylor | |

### *Junior*

| | | | | |
|---|---|---|---|---|
| Anthony Bunk | Walter Hargreaves | F. B. Lutz | E. W. Peters | W. H. Wadsworth |
| A. A. Caddell | R. S. Ives | J. G. Lyerly | R. L. Tanis | R. C. Whitman |
| J. S. Graham | E. A. Krueger | F. J. McDonald | S. E. Thompson | |

### *Associate*

| | | | | |
|---|---|---|---|---|
| S. A. Barbour, Jr. | J. L. DeVries | E. K. Hayslip | W. P. Homans | G. G. Slaughter |
| A. F. Bowles | Frank Evans | J. A. Hendley | R. W. Philip | V. A. Vaughn |
| J. B. Button | W. A. Haines | M. E. Hird | R. J. Quigg | |
| F. H. Couchman | A. W. Hardwick | D. C. Holland | R. J. Schadewald | |

### *Student*

| | | | | |
|---|---|---|---|---|
| J. F. Aulisio | J. C. Farrow | L. E. Long | Henry Ransom | J. R. Taylor |
| Isadore Berman | F. Kobayashi | J. T. Miller | H. W. Rotters | S. V. Vaniotis |
| G. J. Booth | J. A. Lesser | P. C. Peter | S. D. Siegel | H. B. Wolfe |
| J. G. Edwards | | | | G. W. Wright, Jr. |

The following were transferred from Junior to Active membership: W. G. Abbott, Jr., Ralph E. Hale, Samuel G. Newman, Peter Richmond, and Carl J. Spengler.

Respectfully submitted,
HAROLD C. CHAPIN,
*Secretary.*

## SECRETARY'S BALANCE SHEET—FEBRUARY 1, 1937

| | *Applications* | *Dues, Regular and Reinstate.* | *Dues, Corp. and Sustain.* | *Miscellaneous* | *Bank Charges* | *Totals* |
|---|---|---|---|---|---|---|
| Received by Secretary, Nov. 1 to Nov. 30, 1936 | $280.00 | $4,252.95 | $1,670.00 | $38.15 | —$.25 | $6,240.85 |
| Received by Secretary, Nov. 30, 1936, to Feb. 1, 1937 | 427.50 | 2,614.00 | 435.00 | 828.85* | —1.99 | 4,303.36 |
| Total received | 707.50 | 6,866.95 | 2,105.00 | 867.00 | —2.24 | 10,544.21 |
| Transmitted to Treasurer | 707.50 | 6,556.95 | 2,105.00 | 867.00 | | 10,236.45 |
| Leaving to order of Secretary | | 310.00 | | | —2.24 | 307.76 |

*MISCELLANEOUS ITEMS:

| | | | |
|---|---|---|---|
| Annual Meeting Registrations | $614.00 | Knitted Tubing | 2.38 |
| Year Books | 95.37 | Dyestuff Reporters | 14.60 |
| Vat Printing Research Reprints | 18.00 | Crock-Meter Cloth | 3.00 |
| Dye Fastness Reports | 1.50 | Analytical Methods | 1.00 |
| Dyed Standards | 7.00 | | |
| Launder-Ometer Royalties | 72.00 | Total | $828.85 |

AMERICAN
DYESTUFF
REPORTER

A. P. HOWES
Publisher
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Published biweekly by
HOWES PUBLISHING CO., INC.
440 Fourth Avenue, New York City

Subscription price: $5.00 per year. Canadian, $6.00; foreign, $6.00

VOLUME 26 MARCH 22, 1937 NUMBER 6

# Is Litigation Necessary?

HEADLINES proclaim the devasting effects on commerce of floods, drought and war. The entire nation immediately mobilizes to preserve life and almost simultaneously to start the wheels of industry and the flow of commerce. Yet no headlines proclaim the devastating effect on commerce of litigation, nor do reports indicate the amount of money that it tied up, the volume of goods that is prevented from moving, and the ill will that is being manufactured in the courts of law throughout the country in any one day of the year. However, summary figures show that the greatest single item of preventable waste aside from war is litigation.

Is litigation necessary? In cases where an interpretation of the law is required—yes; in cases where the question is one of disputed facts—no. Commercial arbitration, as it is practiced in carefully supervised tribunals under definite rules, provides the alternative for which the astute business man is looking. In England arbitration is a habit of commerce, and rarely do mercantile disputes find their way into English courts. In America the habit is still largely that of litigation, but arbitration is on the increase.

Commercial arbitration is not to be confused with mediation or conciliation which imply compromise. Arbitration is the hearing and determining of a controversy by judges chosen by the parties to the dispute, whose award is rendered on the merits of the case. When the arbitration has been properly conducted the award is enforced by the courts.

When the parties to a dispute decide to arbitrate rather than to take it to court, they may so notify the arbitration committee of their trade association, a chamber of commerce, or the American Arbitration Association. If the case is submitted to the American Arbitration Association, the Secretary of that Association furnishes the parties with the necessary Submission Agreement which they must sign to make the arbitration effective. When this has been done, the Secretary chooses from the Association's panel of arbitrators a list of names of those who would be particularly qualified in the field of the dispute, or who have the type of training the parties require, and sends identical copies of this list to each of the parties. The parties cross off any names of persons whom they do not want, indicate their preference, if any, as to the remainder, and return the lists to the Secretary who makes the appointments from names remaining on both lists. A date and hour convenient for parties, counsel and arbitrators is fixed and at that time the hearing takes place in a private room. Each side presents his case, with or without the aid of counsel, witnesses are examined and exhibits are submitted. If the nature of the case warrants it, the hearing may be adjourned while the arbitrators visit the site of the property in dispute. After all the testimony has been presented, the arbitrators have thirty days in which to make their award, although usually it is handed down within a few days. This award may be entered as a judgment of the court having jurisdiction.

Arbitration is not a new method of administering justice. In ancient Greece and Rome arbitration tribunals were common. Medieval guilds provided arbitration facilities for their members. Then, in the 18th century the Merchant Law, as developed by arbitration tribunals, was incorporated into the common law of England and the law courts undertook to serve the needs of a commerce that had suddenly developed large operations and far flung activities. Since that time the tendency has been a slow swing back to the idea of business men's courts for business disputes, and arbitration has adjusted itself to the scope of modern commerce.

In the United States the growth of arbitration was long hampered by the lack of legislation that would make arbitration effective, for as long as a dissatisfied party could withdraw from the arbitration at pleasure or refuse to comply with the award, there was little to recommend this procedure. However, today all states have arbitration laws that make awards effective and an arbitration association has been formed to standardize arbitration procedure and assume the leadership in advancing legislation. The American Arbitration Association has nation-wide facilities with a carefully chosen Panel of 7000 arbitrators in 1600 cities that has been made available to the business world. As members of the Panel serve without compensation, the

fees of arbitration are very nominal. The Association also publishes "The Arbitration Journal" which reports on developments in arbitration throughout the world.

Arbitration provides a speedy method of settling disputes that is of growing importance as the courts of law are becoming progressively more overcrowded. Speed was an important part of justice in the early days in England when traders met at fairs for the exchange of products, so they established arbitration courts for the duration of each fair and picturesquely called them "Courts de Pie-Poudres" or Court of the Dusty Feet. As the merchants would be travelling on to another fair in a few days the great fair at Stourbridge required each arbitration to be finished with the space of three tides. Today the merchant does not have to move on, but much of the produce of commerce does. Styles and demand change overnight, and speedy delivery is therefore an important element in value. As an arbitration hearing can be arranged quickly and at a definite time, the flow of goods need not be interrupted.

Arbitration provides experts as judges and thereby renders unnecessary a great deal of the technical explanation and education that would have to be presented to a jury. An interesting case in the dyeing industry shows the advantage of the trained arbitrator's background of experience. In this case a silk manufacturer sent twenty-three pieces of goods to a dyeing establishment to be cross-dyed, the design to be a light background with a large check. He later refused to accept the goods, claiming that the background was so dark that it made the merchandise unmarketable. Two silk merchants and the vice-president of a dye works were agreed upon as the arbitrators. After hearing the evidence, they examined the goods and found that as a practical matter it was impossible to dye the goods as ordered by the silk manufacturer. They also found that part of the material could be re-dyed in other combinations that were in considerable demand in the market. They awarded the silk manufacturer an allowance of fifty cents a yard and directed that the goods be re-dyed without charge in five colors to be agreed upon between the parties to the dispute. One of the arbitrators was designated as umpire in case any question should arise as to the five colors.

Such industries as silk manufacturing, wool manufacturing, the theatre, construction, and others have already adopted arbitration as the standard method of settling disputes between members and between members and their customers. Through the use of an arbitration clause in standard contract forms whereby arbitration is agreed upon as the method of settling any dispute arising under or out of the contract or the breach thereof, whole fields of controversy never reach the courts.

Litigation is not necessary. That there are still tremendous fields of industry that depend on "the customer is always right" policy or a fight in the courts to settle all controversies, is probably largely due to the fact that not enough is known about arbitration. As industries that maintain research departments, devoted to increasing efficiency in manufacturing, discover the economic waste of litigation, they will begin to explore and employ an effective alternative—arbitration.

# TECHNICAL NOTES FROM FOREIGN SOURCES

### Resistance to Heat of Certain Diazo Compounds and Theoretical Note Regarding the Formation of Azoic Complexes

*Dr. Justin-Mueller—TIBA* 40, 5 (1936).—In a previous paper, read before the Societe Chimique de France, the author mentioned the relatively prolonged resistance of p-sulfo-diazo-benzene (diazotized sulfanilic acid) to heat. He had previously observed that p-nitro-diazo-benzene chloride, in solution and in the presence of hydrochloric acid, could be heated to boiling without apparent decomposition. To coordinate these observations, by determining the influence of the reaction of the medium, acid or otherwise, it became necessary to look into the question of the formation of diazo-hydroxides, and to correlate this grouping with the phenomena observed.

His work may be summarized as follows:

(1) A simple amino compound containing no other substituting groups (this more exactly should be interpreted as an amino compound of a hydrocarbon, thus including the amines such as toluidines, xylidines, etc., which behave like aniline) gives diazo compounds which are the least stable. In acetic acid reaction, the diazo compound decomposes completely in the heat, even though, during the heating, the solution remains clear; taking on gradually a slightly brown color. If sufficient heat is applied, all of the nitrogen is liberated, and the diazo group replaced by the hydroxyl group, according to a long-known reaction. In a solution acid with sulfuric acid, the same reaction takes place.

(2) If a sulfonic acid group is present in the amine, the diazo solution is considerably more stable toward heat. A hydrochloric acid solution of the diazo salt can be heated to boiling without far-reaching decomposition, but shows more resistance to heat in the presence of a larger amount of HCl. To bring about a complete transformation of the diazo group to the hydroxyl group, it is necessary to boil for at least an hour. In heating a solution acid with acetic acid, there takes place, not this sort of decomposition, but a transformation of the diazo group into an azoic complex.

(3) If a nitro group is present in the ring, the resistance toward heat of the diazo compound in solution in

the presence of HCl is but little less than in the case of a sulfonic group. By prolonged boiling, a nitrophenol is formed. On the other hand, in an acetic acid solution, the stability is no greater than with the nitro-derivative.

The remainder of the paper concerns itself with a discussion of the various structural formulae ascribed to the diazo group, and the view of the author, that, in any case, a diazo-hydroxide is really formed, and is the substance which takes part in an azo coupling. He considers that, in the case of diazotized sulfanilic acid, the first product of the diazotization is a normal diazo-chloride, which becomes hydrolyzed to a diazo-hydroxide, this diazo-hydroxide ultimately condensing, by pairs, to p-p'-disulfo-azoxybenzene. This, however, is his view of the product obtained by heating the usual paste of solid "diazo-sulfanilic acid," and apparently has no particular reference to the constitution of the solid diazo paste itself, used for coupling. The paper is suggestive and stimulating.

## Processing of

# Knitted Wool Underwear Fabric

### *Some Remarks on F. P. Wilsome's Article Under This Heading in this Periodical, Issue No. 25 of December 14, 1936*

RICHARD FEIBELMANN*

I HAVE welcomed the foresaid article because of its dealing with the chlorination of wool in order to make it unshrinkable and thus to give to it a desired quality which it lacks by nature. Certainly, wool chlorinating will become more and more important, for why should the wool fiber remain behind other fibers in the field of modern finishing processes? The English, who hitherto have been leading in chlorinating wool continue to make further investigations for the improvement of this process. Only recently (on December 14, 1936) the "London Times" and other English newspapers have reported new progress which has been made in the laboratories of the Wool Industries Research Association in Torridon, Leeds.

But unfortunately people in this country are not much interested in chlorinating wool, and Mr. Wilsome surely exaggerates when he writes: "most underwear wool fabrics have this treatment today since it is almost essential that the garments made from them be guaranteed unshrinkable." As far as I was able to learn unshrinkable processing of wool is practiced but very little in this country. The reasons are understandable. There is at first the lack of knowledge about the possibility of making wool unshrinkable, not only with the housewife who purchases underwear and knitgoods and launders them but also with merchants. A salesmanager of a prominent underwear factory recently was quite astonished and sceptical when I tried to get him interested in a new chlorinating process. "Unshrinkable wool?" he said, "but that is impossible!" I have convinced him to the contrary by facts. I have had a similar experience with the manager of the hosiery division of a well known New York Department Store. If wool merchants themselves know only little of unshrinkable wool, how can the housewife be blamed? Certainly if she knew of it she would demand unshrinkable fabrics, and then such fabrics would be generally manufactured. But the manufacturer has very little interest in the introduction of such process as something new; he knows that this difficult process requires much experience for the production of a uniformly processed and but slightly attacked fabric, and further, each additional process costs money, and he is fearful that the trade would not pay for it. Also early experiments with bad results as to color, softness, launderability etc., may be responsible for his skepticism. Much educational work must be done in order to produce unshrinkable wool in commercial quantities, and I consider Mr. Wilsome's article as a contribution to this goal. This popularization, however, must not only concern the fact that woolen fabrics (underwear, hosiery, sweaters, garments, sport suits etc.) can be made unshrinkable, but also information about what can be reasonably expected from such "unshrinkable" fabrics. Only too readily the 100 per cent literal fulfillment of the promise is expected. Mr. Wilsome goes so far even as to write "that the garments be guaranteed unshrinkable," as already mentioned. Nevertheless he weakens this demand himself, writing: "If the treatment is carried up to the point at which the wool has a zero shrinkage in subsequent washing then the wool definitely suffers attack", and "the chlorination treatment must be stopped short of that degree necessary to give zero shrinkage and as a result most so-called unshrinkable wool underwear fabric is actually shrinkable on washing repeatedly".

A 100 per cent fulfillment of the promise surely would result in too much attack on the fiber. It must be admitted that an untreated wool can oftener be laundered than a

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chlorinated wool. But what is the difference between hose that must be thrown away because they have become too short and too much felted and which have caused much discomfort while wearing, and hose that retain the original size, the soft feel and original elasticity and clear surface, but must be thrown away at the same time as the shrunken hose? It is the task not to obtain the maximum but the optimum degree of chlorination, in other words to obtain the best possible unshrinkability, to keep the best possible softness and elasticity and to save the best possible launderability and wearability. It is necessary to make a compromise and not to promise too much. A person who is not acquainted with the properties of wool and with the possibilities and results of finishing takes the shrinkage and feltage of a woolen shirt for something inevitable. But he will be greatly disappointed if a so-called unshrinkable shirt becomes a little shorter in the first washing although it keeps its clear, unfelted surface, elasticity and softness. And an underwear knitter will surely criticize an unshrinkable process which yields shirts that lose a little of their length in the washing test. Therefore education is necessary.

There must be a distinction drawn between shrinking and felting. The property of felting is easier influenced by chlorinating than the property of shrinking. This is the reason that "unshrinkable" knitted underwear may keep the original clear, unfelted surface while the length has decreased a little. But this is, of course, an appreciable improvement of the quality as it is especially the felting which, in laundering, reduces the softness and the elasticity, two essential properties of woolen knitgoods.

One special fact has to be emphasized. Circular knitgoods suffer, in mechanical processing, a certain stretch in the length and a contraction in the width and are made into garments in this stretched state. This occurs with common as well as with unshrinkable fabrics. The degree of stretching may differ in a wide range. As soon as such a fabric becomes thoroughly wetted the stretched thread loses its "fixation" and the garment contracts itself according to the degree of stretch previously suffered. This, of course, has nothing to do with the natural shrinkability of the wool but is a self-evident contraction. Unreasonably this contraction is often understood as an unsatisfactory result of the unshrinkable finish. In order to avoid this, stretching in processing should be avoided as far as possible; at least the knitted fabric ought to be stored loosely for some days before rolling it up.

Mr. Wilsome's statement that "so-called unshrinkable wool underwear fabric is actually shrinkable on washing repeatedly" I can lay only to unsufficiently or not properly chlorinated wool. A properly chlorinated wool fabric loses only once a certain percentage of its length due to the natural contraction and the rest of shrinkability that has not been destroyed in order to preserve the quality. But my observations are that such knitgoods shrink somewhat only in the first laundering and then remain constant. This of course, is an important improvement.

As a resume of the above, I draw the following conclusions:

1. The knowledge that wool can be made unshrinkable and not felted should be popularized.

2. The expectations as to the unshrinkability should not be exaggerated.

3. Selfevidently the knitters and/or dyers must have a reliable process for the treatment of the wool. This is a supposition which, as far as I survey the practice, has still not been accomplished.

As to the last point I only need to draw the attention to the process recommended by Mr. Wilsome. According to this formula which he certainly considers as the best, 60 lbs. of fabric are to be immersed, as quickly as possible, into 100 gals. of the chlorinating bath and treated therein during half an hour. The bath contains 10 lbs. sodium hypochlorite solution with 15% available chlorine, that means the bath contains 0.18% available chlorine, further 5 lbs. of hydrochloric acid of 28° Tw. or 0.4% H Cl. "The liquor should smell of chlorine." Certainly it does! Much chlorine ascends into the air from such a solution; more than the worker may stand without protecting equipment. It is not surprising that by this recipe the chlorination results in an effect not uniform as the chlorine reacts quickly with those parts of the fabric which are immersed at first and does not, or only weakly, penetrate the bulk of the material. The volume of 100 gals. of the bath for 60 lbs. of fabric is extremely small, and it seems to be impossible to work properly in such a small bath. Wool chlorinating is, up to the present time, a difficult task; this may be proven by the scanty answers to questions published sometimes in the textile periodicals. He who answers such questions must be presumed to know the subject!

At this point I wish to draw the attention of the reader to a new process which has been mentioned in the "Annual Processing Review Number" of this periodical under the heading "Hypol" on page 680 (issue Nov. 30, 1936). The Hypol process is said to solve the chlorinating problem in the best manner.

In a special contribution I shall write on the methods for making unshrinkable and non-felting wool and its softness problem.

Noticeable are Mr. Wilsome's remarks on softening of woolen fabrics which have become too harsh by the unshrinkable finish. However, I wish to complete these remarks by the statement that there are today means available for the purpose of re-softening of good qualities and of regaining the original loftliness even in an improved degree. But this does not mean that it is possible to make a soft wool from any harsh wool. Wool which is harsh by nature cannot be softened, and wool of a good soft quality which has been chlorinated too much so that it has lost a great deal of its substance is lost at any rate.

# Problems of the Textile Industry

*(Continued from page 148)*

among too many textile workers, formed the American Association of Textile Chemists and Colorists. This Association is exactly analogous to yours. I can say without exaggeration that it has been very successful.

It has had committees at work for fourteen years and these have done a great deal to accumulate exact information on such important subjects as the establishment of standards for the fastness to light of dyes on all fibers, the real chemistry of wool degradation by oxidation and reduction, the relation between physical properties, especially viscous flow, and the useful qualities of printing pastes, the exact facts of wool carbonizing, a workable method for the quantitative estimation of wool, cotton, silk and rayon in mixtures of two or more of these, the testing and setting up of suitable standard methods for testing fastness to washing on silk, wool and cotton, for determining resistance to perspiration, and many other useful methods.

Much of this was done by the unselfish devotion of the members who gave ungrudgingly of their time, but the systematic research calling for full time by a scientifically trained worker could not have been financed by the Association. The necessary monies came from a public source, the Textile Foundation, chartered by Congress to administer a large fund for the benefit of the people in promoting the welfare of the textile industry, from seed sowing to selling finished products. The Textile Foundation, convinced of the importance of the work the Association wished to carry on, made the necessary grants. We believe that this was as wise as it was generous. Already results have been obtained that will be of direct practical value, for example, the method of testing for wool damage described by Harris and the positive correlation of paste viscosity under various stresses, to printing quality, demonstrated by the work of Glarum.

### Work of the U. S. Institute for Textile Research

In addition to this there was organized some years ago a U. S. Institute for Textile Research, the idea being to make it an association of all the textile manufacturers of importance, as well as of individuals interested in this special application of research, in order that the mills might have the benefit of the services of scientific investigation without undertaking the very nearly impossible task of setting up research departments within their own four walls. The response to this effort, which it was hoped would result in something resembling the Shirley Institute and the Wool Research Institute of Great Britain, has been extremely disappointing. Three important lines of investigation were undertaken with funds partly contributed by members and partly by the Textile Foundation. Of these, that dealing with the throwing of rayon crepe yarns and the determination of the exact conditions for getting a uniform crepe or pebble has been brought to a successful conclusion, although the work might very well be carried further with advantage. Of the other two, one on the relation of driving in all its forms, to fiber quality both in working and wear is only just begun; the other on warp sizing rayon warps is not complete but is leading the research committee in charge to ideas that are revolutionary —and this under the chairmanship of no visionary but of an extremely practical mill man of long experience.

### Apathy of U. S. Textile Manufacturers Towards Scientific Research

But the textile industry has not done much to recognize the value of this work and the Research Institute remains a dream; actually of the sum contributed to finance the work done and match the grants of the Textile Foundation nearly all has come from the textile auxiliary industries, the makers of dyes, textile machinery, textile assistants, etc. This is extremely disappointing. However, there has been such a heavy emphasis on the necessity for research that the industry (I am speaking of the United States) is setting up the defense that they are doing an immense amount. Unfortunately this is only true if the meaning of research is debased to cover any search for new weaves, new methods of marketing, new mechanical ways of doing things and the like. It does not reach to the real underlying facts any more than the chef discovers vitamines.

It is not too much to say that in proportion to its income the textile industry of the United States is supporting practically no real research, and is not undertaking it individually. This is offset to some extent by the fact that the industries supplying the fabricators of textiles with equipment and synthetic fibers, and auxiliary materials are very active. But this can never take the place of investigation carried out for the welfare of those who should be most interested, the mill owners with funds coming from the industry. I do not wish to imply that the industry will perish because it refuses to buy gold dollars for fifty cents, as it can by investing in research, but I do state categorically that the result will be very detrimental, will prevent the industry from realizing many economies and new developments and will render it less able to withstand shock.

To you I say these things because I feel that your problems are in no small measure the same as ours and I want you to know that we feel that our most important task is to arouse the leaders of the industry to the need for real research. So far we have not succeeded, but we have, none the less, formed a nucleus around which those who appreciate research have gathered. We have done more than that, we have initiated and carried to a successful conclusion problems calling for the determination of facts and their evaluation in terms of usefulness in the mill. We have proved to those willing to be reasonable that research does in reality pay its way; that exact knowledge of the right kind is never costly no matter what it may cost.

# TRADE NOTES — NEW PRODUCTS

## OBITUARY

### GEORGE M. SNOW

George M. Snow, well-known dyestuff representative in New England, died on February 22nd in his 78th year. He had been in ill health for several years but death was due to pneumonia from which he suffered only a few days.

Mr. Snow was educated in Boston and in 1892 became resident manager of a dye import company and had headquarters in Providence. The import company was later incorporated into the Badische Co. of New York and he became vice-president and director. He resigned these offices shortly after the United States entered the World War and affiliated with E. I. du Pont de Nemours & Co. as New England manager of the dyestuffs selling force with headquarters in Providence. He was also interested in the Peoples' Savings Bank and had held membership in the Hope Club, Squantum Association, Rhode Island Country Club, Providence Art Club, Turks' Head Club and the Society of Mayflower descendants.

He is survived by his wife, a son and two granddaughters, all of Providence.

### LIONEL F. HEADING

Lionel F. Heading, president of Heading, Inc., of Long Island City, N. Y., died suddenly of pneumonia at his residence in Forest Hills, Long Island, on March 2nd. He was forty-six years old.

He was born in England and came to this country in 1919 and with his brother Frank organized the firm which bears the family name. His brother will continue to carry on the business.

Besides his brother Frank he is also survived by his wife and a daughter and by his mother, father, sister and another brother who reside in Jersey, Channel Islands.

### • JAPANESE CHEMICAL INDUSTRY

The Japanese chemical industry continued its expansion program last year and judging from new capital invested—153,325,000 yen ($45,995,000)—made substantially the same progress as in 1935, according to reports from American Trade Commissioner Paul P. Steintorf, Tokyo, made public by the Commerce Department's Chemical Division.

In 1936, however, more attention was given to the expansion of existing plants and less to the establishment of new companies, thus reversing the tendency noted in the preceding year, the report states.

Important developments in 1936 included application of the industrial control law to chemical fertilizer production and partial enforcement of the self-sufficiency policy with respect to liquid fuels—the latter resulting in the formation of a number of new power alcohol and coal liquefaction companies, it was stated.

A number of new chemical products and processes were introduced though some were still in the laboratory stage as the year closed and many processes and products reported in former years were developed commercially, according to the Trade Commissioner.

Very substantial progress in the direction of general self-sufficiency was made and important economies were effected by consolidations the report states.

Dyestuffs manufacturers achieved considerable success in producing the higher grade colors, formerly imported, and in developing new intermediates. Here again domestic consumption increased so rapidly that home production was inadequate. Dye imports reached the highest level since 1929 and exports declined substantially.

### • CHEMICAL IMPORTS

United States imports of chemicals and related products in January maintained the high level that has been recorded in recent months and were characterized by a sharp contraction in receipts of industrial drying oils, according to C. C. Concannon, Chief of the Commerce Department's Chemical Division.

Receipts of dyes, waxes, glycerine, potash, nitrate, and a number of other raw and semi-manufactured materials destined for industrial consumption were especially heavy during the month, he stated.

The total value of our import trade in chemicals, industrial oils, waxes, and related products aggregated $13,000,000 in January, approximately the same as during the preceding month, and compares with receipts valued at $12,000,000 in January, 1936, according to preliminary statistics.

Imports of industrial chemicals increased substantially to a total value of $2,248,000 in January—a value gain of approximately $650,000 over January, 1936, due in large part to heavier receipts of glycerine, it was stated. Records show that approximately 3 million pounds of glycerine, half crude and half refined, were imported during the month whereas practically none was brought in during January, 1936.

Imports of coal-tar dyes, largely from Germany and Switzerland, were heavier in January bringing the total value of all coal-tar product imports to $1,251,500 during the month against receipts valued at $854,350 in January, 1935.

Declines were recorded in imports of casein, gums, resins, balsams, dyeing and tanning materials, medicinal materials and matches, it was stated.

### • CHEMICAL EXPORTS

United States exports of chemicals and related products in January were the highest for any January in recent years despite the marked contraction in foreign demand for American fertilizers during the month according to C. C. Concannon, Chief of the Commerce Department's Chemical Division.

While exports of fertilizers in January amounted to only 61,000 tons—the smallest amount reported for any month in the past two years—decreases recorded in this classification were more than offset by spectacular increases in export shipments in ready mixed paints and varnishes, insecticides, medicinals, disinfectants, polishes, plastic materials, synthetic resins, soaps and toilet preparations, heating and refrigerating gases, and a number of other high grade specialties, he stated.

The total value of all chemicals and related products exported in January aggregated $12,147,000 compared with shipments valued at $11,584,000 in January, 1936; $9,298,000 in January 1935; and only $6,858,000 for January 1933, statistics show.

Chemical specialties headed the list in January with total exports in this classification reaching the value of $2,081,800—a value increase of more than 60 per cent compared with January, 1936, during which year the total was recorded at $1,298,000, according to Mr. Concannon.

### • CHEMISTRY EXHIBIT

Ten 18-inch walking dolls will present an animated and colorful Easter fashion show opening about March 20 at the New York Museum of Science and Industry in the RCA Building, Rockefeller Center. The specific function of these miniature mannequins, as they parade one after the other along the runway to a platform where they pose and revolve in accurate mimicry of life-size models, is to demonstrate the high point of beauty and style which science has achieved in the manufacture of Acele rayon. The fashion show will be a feature of an exhibition showing new research developments in chemistry from the laboratories of E. I. Dupont De Nemours and Company.

Officially titled "Better Things for Better Living Through Chemistry," the exhibition will be a varied and dramatic

presentation of the most recent contributions to everyday living which science has drawn from the natural resources of the earth and turned over to men and women for their practical purposes. Push-a-button exhibits, demonstrations, transparencies, dioramas, pictures and exhibits in motion will all be used to show how such raw materials as coal, salt, miscellaneous ores, vegetable oils, cotton and wood have been turned into plastics, paints, dyes, explosives, textiles, refrigerants and numerous other things

Of special popular interest will be a demonstration of the manufacture of cellophane.

### • NETHERLANDS INDIAN CHEMICAL INDUSTRY

Reports circulated at the close of 1936 that the Netherlands Indian Government has been negotiating with a syndicate of important foreign chemical manufacturing concerns for the establishment of a major chemical industry are believed to have been somewhat premature, according to reports from the American Trade Commissioner at Batavia made public by the Commerce Department's Chemical Division.

It has been known for some time, however, that the Government has been making serious study of the possibilities of producing caustic soda by electrolysis in the Madura salt fields and it is probable that there will be some development along this line in the near future, the report states.

So far as is known at present the Netherlands Indian Government does not intend to participate in any branch of the chemical industry which may be established in that country, but there is little doubt that it will lend its aid in promoting the organization of any local enterprise which promises to make the Netherlands Indies self-sufficient in certain industrial chemicals which are required by local industries, the report states.

Caustic soda is imported into the Netherlands Indies for use by soap manufacturers and other concerns. A total of 5,135 metric tons were brought in last year, against 6,978 tons in 1935, according to the report.

### • BRITISH CHEMICAL INDUSTRY

The British chemical industry which is frequently referred to as the "barometer of British business" did not merit that reputation in 1936 but as the year closed there were unmistakable signs that the industry was rapidly approaching the high level of production already enjoyed by most other manufacturing units, according to a report from Warren S. Lockwood, Assistant American Trade Commissioner, London, made public by the Commerce Department's Chemical Division.

Although the chemical industry index did not advance so strikingly as those of certain other major groups, production during each of the first three quarters was considerably higher than that recorded for the corresponding period of 1935, and it is anticipated that production for the final three months will record still further gains, the report states.

The year was especially satisfactory for manufacturers of heavy chemicals and dyestuffs. The former profited from the record year enjoyed by the iron and steel, engineering and construction, and manufacturing enterprises generally. Recovery in the textile industry contributed most to the increase in dyestuffs consumption, it was stated.

### • USS EXHIBIT

Featuring USS Stainless Steel and its increasingly successful application in the textile industry particularly in dyeing processes, subsidiary companies of the United States Steel Corporation will present a colorful, interesting, and informative exhibit at the Southern Textile Exposition at Greenville, South Carolina, April 5th to 10th, 1937.

The central attraction at this exhibit will be a presentation of the advantages of USS Stainless Steel as used in the textile industry for dye tanks and vats. There will be a clear exposition of the application of USS Stainless Steel in solving the problem of uniform color in dyed fabrics.

### • STAINLESS SHOVEL

Said to put another notch in its ever-growing list of new applications, stainless steel is being used for the blade of a new kind of shovel manufactured by the Ames-Baldwin-Wyoming Company, of Parkersburg, West Virginia.

The shovels are designed for use wherever chemicals or chemically treated products are handled. They also are recommended by the manufacturers in the handling of coal and coke that has been sprayed with calcium to keep dust at a minimum.

Armco 18-8 hot rolled strip pickled stainless steel, manufactured by The American Rolling Mill Company, Middletown, Ohio, is being used. Three types of shovels, all with No. 2-B finish stainless, are offered by the company. They include hollow back round and square point stainless shovels.

### • HOUGHTON SIZE CHECK-UP TEST

Featuring the Houghton Size Check-Up Test—a method of analysis of warp sizing procedure—E. F. Houghton & Co. will be well represented in the Southern Textile Exposition to be held in Greenville in April.

Enlarged photographs of warps, sized according to recommended formulae, as compared with unsized and competitive sizes, will be displayed.

A new feature of the exhibit will be a demonstration of the new Raylubric Pebble Control Process which guarantees uniform crepage by use of a one-piece product made in three varieties to furnish fine, medium or coarse pebble to the crepe.

Rayon sizing products will also be displayed with examples of lower cost per 1,000 yards of sized material.

The Leather Division of E. F. Houghton & Co. will be represented by a demonstration of Vim Tred Leather Belt and samples of various textile leathers supplied to the trade.

Sta-Put Lubricants for textile machinery will also be exhibited to show the superior film strength and non-splattering characteristics.

A feature of the exhibit will be the maintenance of free local telephone service so that incoming calls may be handled at the Houghton booth without charge.

Among the representatives in attendance at the exhibition will be G. S. Rogers, W. H. Brinkley, D. C. Miner, H. C. Roberts, C. B. Kinney, J. J. Reilly, J. A. Brittain, D. O. Wylie, B. E. Dodd, J. W. Byrnes.

### • JOINS J. P. STEVENS

J. B. Goldberg, until recently Director of the Research and Development Department of S. Slater & Sons, Inc., Webster, Mass., is now associated with J. P. Stevens and Co. in New York City, where he is in charge of a newly established laboratory. Mr. Goldberg has been engaged in chemical and textile research since his graduation from the Mass. Institute of Technology in 1926. Prior to his affiliation with the Slater Mills, he was employed by the Celanese Corporation of America and the U. S. Industrial Chemical Company.

### • ONYX PROMOTION

Leon P. Brick, for 12 years special field representative of the Onyx Oil & Chemical Co., Jersey City, N. J., has been appointed Assistant General Sales Manager.

Mr. Brick, whose father E. A. Brick has been associated with the Onyx Company for 26 years, will continue to devote a portion of his time in contact with his many friends throughout the trade.

### • NOPCO TRANSFER

George M. Cunningham of the technical sales division of the National Oil Products Company of Harrison, N. J., has been transferred to the San Francisco office, Charles P. Gulick, president of the company, announced today. Mr. Cunningham will take his new post on April 1.

Mr. Cunningham has been engaged in product and market development at Har-

rison for five years. At San Francisco he will assist in the marketing of National Oil's new sulfonated oil products for the paper, textile, leather and allied trades.

### • ACQUIRES H. A. METZ OF NEWARK

The American Cyanamid & Chemical Corporation announces the acquisition of the business of H. A. Metz & Co., Inc., of Newark, N. J., as of March 1, 1937. The business of H. A. Metz & Co., Inc., will be consolidated with that of the American Cyanamid & Chemical Corporation and operated in the latter name.

H. A. Metz & Co., Inc., have been prominent in the manufacture and distribution of textile and tanning chemicals and specialties. These will be manufactured and distributed as in the past with the added facilities of the American Cyanamid & Chemical Corporation as to research, development and distribution.

### • MULTIPLE PIECE DYE SYSTEM

Announcement has been made of the new "Fleet Line" Multiple Piece Dye System (Patented). This system consists essentially of a series of two to six kettles of any given standard size all fed from one dye tank by means of a pump. The kettles are so connected to the dye tank that one or more of them can be cut out of production at any time by the turn of a valve. Furthermore, these kettles when cut out of the system can be used as individual dye kettles for producing different shades if desired.

This system can be supplied complete or can be applied to existing dye kettles. It has been successfully used for sometime by a large manufacturer of pile fabrics. It is applicable in cases where a large yardage of one shade is desired. All kettles, being fed from one dye tank, are said to produce colors of absolutely uniform shade.

Riggs & Lombard, Inc. of Lowell, Mass. have obtained exclusive rights to manufacture and sell this machine to woolen, worsted, and knit goods manufacturers.

### • GEIGY RELEASE

Geigy Company, Inc., 89 Barclay St., New York City announces release of a shade card entitled:

*Diazotized and Developed Colors on Rayon.*—These diazophenyl colors are intended for application on all types of rayon as well as cotton goods in the form of piece goods, yarns or raw stock. It is stated that in general they have good solubility, dye level and can therefore be used to advantage in the average dyeing machine. They are particularly recommended by the manufacturers for their fastness to washing in which respect they are said to be superior to the well-known direct dyeing colors. It is further stated that Diazophenyl colors as a group can hardly be regarded as possessing exceptionally good fastness to light, especially when dyed in light and medium shades. However, it is said that these colors are usually selected when shades of considerable depth are required and, therefore, light fastness is of secondary consideration. It is claimed that these types, with few exceptions, have good dischargeability and are useful for securing grounds on piece goods for white and colored discharge printing.

There are a number of dyed sample swatches illustrating the various colors and there are also included in this shade card instructions for dyeing, diazotizing and developing as well as tables indicating the fastness properties. Shade Card No. 273-D.

### • RESIGNS FROM K-H

Announcement has been made of the resignation of Frederick Kenney from Kenney-Herstein, Inc. The consulting chemical practice will continue under the name of Herstein Laboratories, Inc. with headquarters at 18 East 41st Street, New York City.

### • TAG CATALOG

C. J. Tagliabue Mfg. Co., Park and Nostrand Aves., Brooklyn, N. Y., announces release of a new catalog (No. 900C) which completely describes and illustrates the latest models of Tag Non-Indicating Controllers for temperature, pressure and time. The book also contains a comprehensive discussion of various types of Tag controllers, their applications and how they work. Copies are available upon request.

# OPEN FORUM

**Rules under which this department of the REPORTER is conducted are as follows:**

**1. Anyone who has a technical problem on which he would like advice may submit it to the Reporter and it will be published in the first available issue.**

**2. Any reader who feels that he has a solution of the problem may forward his reply to us and if we feel that the reply is suitable it will be published in a succeeding issue.**

**3. For each such reply published the Reporter will pay a minimum of $2.**

**4. In case there is more than one answer to the same question, the one covering the subject in the most complete and authentic manner will be published, or if two answers are sufficiently different both will be published. If two answers are considered equally good, the one first received will be given priority.**

**5. The Reporter will assume no responsibility whatsoever for the accuracy of the answers submitted—it is simply offering a vehicle for the public expression of its readers' opinions.**

**6. Both the questioner and answerer must send in his complete name and address. When requested we will publish only the initials or other identifying insignia.**

**40**—Can creases in knit goods for underwear be eliminated? The fabric is kier boiled in a vomit kier for twelve hours under twelve pounds pressure, then given a hypochlorite bleach and finished by passing through a mangle.

These creases appear before going through the mangle, and the mangle does not press them out. Information or suggestions will be appreciated.—**W. H. F.**

## CLASSIFIED

**The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.**

CHEMIST WANTED: Established dyestuff manufacturer wishes to contact experienced organic chemist familiar with dyestuff and intermediate development and manufacture. All applications will be treated strictly confidential. Write Box No. 941, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.